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REPORT OF CAPT. E. W. VAN C. LUCAS, CORPS OF ENGINEERS.

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Improvements.—Savannah Harbor, Ga., 1559; Savannah River between Augusta and Savannah, Ga., 1567; Savannah River above Augusta, Ga., 1571; Doboy Bar, Ga., 1573; Darien Harbor, Ga., 1574; Altamaha River, Ga., 1578; Oconee River, Ga., 1580; Ocmulgee River, Ga., 1582; Brunswick Harbor, Ga., 1585; inside water route between Savannah, Ga., and Fernandina, Fla., 1590; removing sunken vessels or craft obstructing or endangering navigation, 1592.

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Improvements.—Cumberland Sound, Ga. and Fla., 1593; St. Johns River, Fla., from Jacksonville to the ocean, 1597; St. Johns River at Orange Mills Flats, Fla., 1600; Volusia Bar, Fla., 1602; Ocklawaha River, Fla., 1603; St. Augustine Harbor, Fla., 1607; Indian River, Fla., 1608; harbor at Key West, Fla., and entrance thereto, 1610; removing the water hyacinth from Florida waters, 1612; dredge for river and harbor improvements, Fla., 1613.

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Survey.—Tampa Bay, Fla., from Port Tampa to mouth of bay, in Gulf of Mexico, 1640.

Harbor Lines.—Hillsboro River at Tampa, Fla., 1643.

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REPORT OF CAPT. C. A. F. FLAGLER, CORPS OF ENGINEERS.

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INSPECTION of the improvement of the South Pass of the Mississippi River, 1815.

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REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

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AMOS STICKNEY, lieutenant-colonel, Corps of Engineers, U. S. A., president; Thos. H. Handbury, major, Corps of Engineers, U. S. A.; W. L. Marshall, major, Corps of Engineers, U. S. A.; Messrs. G. C. Broadhead and C. L. Chaffee, *Commissioners.*

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S. M. MANSFIELD, colonel, Corps of Engineers, U. S. A., president; W. H. Heuer, major, Corps of Engineers, U. S. A.; Herbert Deakyne, first lieutenant, Corps of Engineers, U. S. A., *Commissioners.*

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IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND, ON THE SOUTHERN SHORE OF LONG ISLAND, AND OF HARLEM AND EAST RIVERS, NEW YORK.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, LIEUT. COL. W. H. H. BENYAURD AND MAJOR H. M. ADAMS, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Port Chester Harbor, New York.
2. Mamaroneck Harbor, New York.
3. Larchmont Harbor, New York.
4. East Chester Creek, New York.
5. Bronx River, New York.
6. Mattituck Harbor, New York.
7. Port Jefferson Harbor, New York.
8. Huntington Harbor, New York.
9. Glencove Harbor, New York.
10. Flushing Bay, New York.
11. East River and Hell Gate, New York.
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13. Newtown Creek, New York.
14. Wallabout Channel, New York.
15. Canarsie Bay, New York.
16. Browns Creek, Sayville, Long Island, New York.
17. Patchogue River, New York.
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19. Wallabout Channel, New York.

HARBOR LINES.

20. East River at Rikers Island, New York.
21. East River, between Bungay and Cabot streets, Oak Point, New York.
22. East River, between East Twenty-third and East Twenty-fourth streets, New York City.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., July 24, 1899.

GENERAL: I have the honor to transmit herewith annual reports upon the works of river and harbor improvements under my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

Port Chester Harbor is on the boundary line between the States of New York and Connecticut. It consists of the tidal part of Byram River and of a bay at its mouth.

PROJECTS FOR IMPROVEMENT.

In 1872 a project for improvement was adopted, which, as subsequently modified, consists in removing Salt Rock to 9 feet below mean low water, building a breakwater from Sunken Rock to Byram Point, and dredging to make and maintain a channel to the Port Chester wharves, at a total cost of $57,000.

This project has been completed, except the dredging in the upper harbor.

By act of Congress approved March 3, 1899, an appropriation of $25,000 was made "to be expended in enlarging the channel below and up to Town Dock to a depth of 12 feet and a width of 70 feet, and from Town Dock to the steamboat dock to a depth of 9 feet and a width of 60 feet."

A project for the expenditure of the available funds in accordance with the terms of this act was submitted, and was approved by the Secretary of War March 20, 1899.

The work, it is estimated, will require the removal of 78,000 cubic yards of mud, sand, and gravel, and of 650 cubic yards of rock and large bowlders.

The length of the channel from deep water up to Town Dock is about 2,500 feet, and thence up to the steamboat dock about 4,200 feet.

Detailed descriptions of the harbor and of the project for improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1084.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations were in progress during the year.

Specifications were prepared and advertisement made, inviting proposals for dredging and rock excavation under the existing project.

Bids for the improvement were opened May 17, 1899, but being considered too high were rejected, with a view to readvertising the work.

PRESENT CONDITION OF IMPROVEMENT.

Salt Rock has been removed to a depth of 9 feet below mean low water. The breakwater has been built from Sunken Rock to high-water mark on the rocks at Byram Point, leaving a gap 30 feet wide near the shore end, to allow small boats to pass through at high tide. The end of the breakwater has been built up to 15 feet above low water, to serve as beacon upon Sunken Rock.

A channel has been dredged from deep water in the bay to the steamboat landing at Port Chester, a distance of about 6,300 feet, with depth of 8 feet at mean low water and width of 75 feet up to Town Dock, and above that point with depth of 6 feet at mean low water and width of 60 feet; at the bend at the steamboat landing the width was made 100 feet. Above the steamboat landing the depth is 2½ feet at mean low water.

PROPOSED OPERATIONS.

The available funds will be applied in deepening and widening the existing channel.

Further appropriations should be applied in maintaining the improved channel, which is subject to shoaling.

Under the terms of the river and harbor act of March 3, 1899, a preliminary examination, with a view to the further improvement of this harbor, will be made.

Port Chester Harbor is in the collection district of New York. The nearest lighthouse is on Great Captains Island, 1¾ miles east of the mouth of the harbor The nearest works of defense are the fortifications on Davids Island, New York, 9 miles to the southwest.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$25,000.00
June 30, 1899, amount expended during fiscal year	36.03
July 1, 1899, balance unexpended	24,963.97
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	5,000.00

Appropriations for improving Port Chester Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Removing Salt Rock	June 10, 1872	$12,000
Dredging in Byram River and Bay	Aug. 2, 1882	15,000
Breakwater	Aug. 11, 1888	5,000
Do	Sept. 19, 1890	5,000
Do	July 13, 1892	5,000
Breakwater and dredging	Aug. 18, 1894	5,000
Dredging 6 feet depth	June 3, 1896	5,000
Dredging	Mar. 3, 1899	25,000
Total		77,000

No contract for this improvement has been in force during the past fiscal year.

Abstract of proposals for dredging and rock excavation in Port Chester Harbor, New York, received in response to advertisement dated April 17, 1899, and opened May 17, 1899, by Maj. H. M. Adams, Corps of Engineers.

No.	Name and address of bidder.	Dredging 78,000 cubic yards (per cubic yard).	Rock excavation, 650 cubic yards (per cubic yard).	Amount.
1	Du Bois Bros. Dredging Co., 19 Whitehall street, New York City	$0.21	$11.00	$23,530
2	The Hartford Dredging Co., Hartford, Conn	.21	11.60	23,920
3	The International Contracting Co., Syracuse, N. Y	.19½	9.50	21,385
4	Charles W. Johnston, Lewes, Del	.49	15.00	47,970

All bids rejected, being considered too high.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

Arrival and departure of vessels.

	Number of round trips.	Draft.	Tonnage.
		Feet.	*Tons.*
Steamers	430	5 to 9.6	20 to 268
Steam tugs	400	4 to 9	10 to 60
Sail vessels	90	6 to 13	40 to 400
Barges	305	5 to 10	100 to 800
Total	1,225		

Freight received and shipped by water.

	Tons.	Estimated value.
Receipts:		
Coal	40,000	$180,000
Building materials	30,000	135,000
Miscellaneous	42,000	1,230,000
Total	112,000	1,545,000
Shipments:		
Farm produce	4,000	91,000
Manufactured goods, etc	24,000	3,300,000
Total	28,000	3,391,000

The above figures show an increase of 21,050 tons in amount of freight over that reported for 1897.

No new lines of transportation are reported as established since July 1, 1898.

E 2.

IMPROVEMENT OF MAMARONECK HARBOR, NEW YORK.

Mamaroneck Harbor, on the north shore of Long Island Sound, about 5 miles west from the Connecticut State line, consists of an open shallow bay and a narrow tidal inlet about a mile long.

The channel to the old steamboat wharf (about halfway up the inlet) had a depth of 5 feet at mean low water. From there to the upper wharves the depths gradually decreased to 1 foot. At and near its mouth the inlet was obstructed by several rocks.

The mean rise of tide at Mamaroneck is about 8 feet.

PROJECT FOR IMPROVEMENT.

A survey of the harbor was made in 1881, in pursuance of the river and harbor act of that year, and a project for improvement was submitted, and under the river and harbor act of 1882 was adopted. This project consisted in removing Round Rock, in the upper channel, to a depth of 4 feet at mean low water; in removing five other rocks (Bush Rock, part of Nells Rock, Inner Steamboat Rock, Outer Steamboat Rock, and Little Nanhook) to a depth of 7 feet, and in dredging a channel 7 feet deep and 100 feet wide from Long Island Sound to the old steamboat wharf, and thence 4 feet deep and 80 feet wide to the upper wharves, together with the closing of a small channel east of "Grassy Knoll," at a total estimated cost of $43,000.

Under appropriations made in 1882 and 1896 Round Rock was removed to 4 feet below mean low water, and Bush and Inner Steamboat rocks to 7 feet depth, and a channel 60 feet wide and 6 feet deep at mean low water was dredged to the upper steamboat dock (a distance of about 3,000 feet) and was extended 200 feet farther with 35 feet width.

By act of Congress, approved March 3, 1899, an appropriation of $7,000 was made to continue the improvement.

Since the adoption of the project of 1882, conditions in Mamaroneck Harbor have changed. The old steamboat wharf, where it was supposed that most of the water freighting would be transacted, has been practically abandoned, and business transferred to the upper wharves. Under these conditions it was found that the three rocks remaining to be removed are not nearly as serious an obstruction as the scant depth in the upper harbor. In submitting the project for the available funds it was therefore recommended that the present project be modified, so as to omit the removal of the three outer rocks, and to extend the channel 7 feet deep and 100 feet wide, from the old steamboat wharf to the upper wharves, without changing the estimated cost for completion. The project as modified was approved by the Secretary of War April 27, 1899.

A sketch of Mamaroneck Harbor was printed in the Annual Report of the Chief of Engineers for 1886, page 658.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations were in progress.

Specifications were prepared for dredging, and, if necessary, rock removal, to make the channel to the upper wharves 7 feet deep at mean low water, with width as great as the available funds will permit. Proposals for the work were opened June 24, 1899. One bid was received, at 27½ cents per cubic yard for dredging and $8 per cubic yard for removing rock and bowlders, and its acceptance was recommended.

PRESENT CONDITION OF IMPROVEMENT.

Round Rock has been removed to a depth of 4 feet at mean low water, and Bush and Inner Steamboat rocks to 7 feet depth.

A channel 6 feet deep at mean low water has been dredged from deep water to the upper steamboat dock 60 feet wide, and extends 200 feet farther up the harbor with 30 feet width.

PROPOSED OPERATIONS.

The available funds will be applied to deepening and widening the channel to the upper wharves.

Mamaroneck Harbor is in the collection district of New York. The nearest lighthouse is on Execution Rock, about 4 miles south. The nearest works of defense are the fortifications on Davids Island, New York, 5 miles to the south-southwest.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$7,000.00
June 30, 1899, amount expended during fiscal year	22.97
July 1, 1899, balance unexpended	6,977.03
Amount (estimated) required for completion of existing project	11,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	11,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Mamaroneck Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Removal of rocks	Aug. 2, 1882	$15,000
Dredging	June 3, 1896	10,000
Do	Mar. 3, 1899	7,000
Total		32,000

No contract for this improvement has been in force during the past fiscal year.

Abstract of proposals for dredging and excavation in Mamaroneck Harbor, New York, received in response to attached advertisement dated May 24, 1899, and opened June 24, 1899, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers.

No.	Name and address of bidder.	Dredging per cubic yard.	Excavation per cubic yard.	Approximate amount of material that can be removed under available balance.	
				Dredging.	Amount.
[a] 1	James McSpirit & Sons, 122 Wayne street, Jersey City, N. J.	$0.27½	$8.00	*Cubic yds.* 22,000	$6,050.00

[a] Only bid.

COMMERCIAL STATISTICS.

A statement of commerce for the calendar year 1898 has been asked for, but not yet received. Following are the commercial statistics reported for the calendar year 1897:

Arrivals and departures of vessels.

Kind of vessel.	Number of round trips.	Draft.	Tonnage.
		Feet.	*Tons.*
Steamers (2)	150	7 to 8	54 to 113
Steam tugs (5)	90		
Sail vessels	6	7 to 9	120 to 200
Barges, canal boats, etc	90	7 to 9	100 to 650
Total	336		

Freight received and shipped by water.

Articles.	Received.		Shipped.	
	Tons.	Estimated value.	Tons.	Estimated value.
Coal	11,800	$47,200		
Building materials	6,873	68,730		
Crushed stone	9,000	11,250		
Railroad ties, iron, and miscellaneous	21,000	630,000	3,000	$120,000
Total	48,673	757,180	3,000	120,000

The total tonnage of above commerce, 51,673 tons, is greater than that reported for 1896 by 19,578 tons.

No new lines of transportation are reported established since July 1, 1898.

E 3.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

Larchmont Harbor is a bay on the northwest shore of Long Island Sound, about 25 miles by water from the Battery, New York City, and 6 miles southwest from the boundary between the States of New York and Connecticut.

The harbor is about half a mile wide and extends rather more than half a mile inland. It is a basin with no definite channel, the low-water depth of 18 feet at the entrance gradually decreasing toward the shores east, north, and west.

The harbor is chiefly used by the Larchmont Yacht Club, but is more or less sought by small coasters and fishing vessels for refuge or for night anchorage. It is exposed to storms from east to south, and during northeast storms heavy seas roll around Long Beach Point, east of the harbor, and compel vessels to go well up into shoal water for shelter. The entrance is divided into three channels by two rocks, Umbrella Rock, about 800 feet from the west shore, being a large ledge with least depth of 3.1 feet at mean low water, and Huron Rock, about 900 feet southwest from the east shore, a smaller ledge with least depth of 9.8 feet. The channel between the rocks is over 900 feet wide and is the one almost invariably used. There are other rocks inside the harbor which are well known and are marked by spindles; they are too near the west shore to interfere with the use of the harbor for general navigation. The mean range of tides is 7.4 feet.

PROJECTS FOR IMPROVEMENT.

The river and harbor act of August 11, 1888, provided for a survey of Larchmont Harbor, which was made the following year. The report on the survey, dated November 26, 1889, was printed as House Doc. No. 40, Fifty-first Congress, first session, and also in the Annual Report of the Chief of Engineers for 1890, Part I, page 675. With the report were presented two alternative projects for improvement, one for removal of Umbrella and Huron rocks, the other for breakwater to cover each rock and extend to the nearest shore; the cost of removing the rocks to 15-feet depth at mean low water was estimated at $126,000, and the cost of the two breakwaters at $105,000. At the date of the report the preference of those most interested in the harbor was expressed in favor of removing the rocks. After further consideration they changed their views, preferring the breakwater, and in accordance with their petition or request a clause in the first draft of the river and harbor act of 1890 which required that the money appropriated for the harbor be expended "to remove obstructions at mouth of harbor" was stricken out.

The project for constructing two breakwaters at the mouth of the harbor was approved by the Secretary of War September 27, 1890, after the first appropriation for improving the harbor was made. Up to July 1, 1899, 74 linear feet of Umbrella Breakwater and 64 linear feet of Huron Breakwater had been built.

The river and harbor act of March 3, 1899, provided for—

> Improving harbor at Larchmont, New York: Continuing improvement, fifty thousand dollars: *Provided*, That said sum, or such part thereof as may be necessary, may be used by the Secretary of War on such project under any modified plan that may hereafter be adopted by him.

After conference with those most interested in the improvement of the harbor a modified project was submitted to the Chief of Engineers by Maj. H. M. Adams, under date of March 31, 1899, and approved by the Secretary of War April 18, 1899. The modified project for the improvement of this harbor now consists in building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and in the removal of Huron Rock to a depth of 14 feet at mean low water, at an estimated cost of $108,000.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations have been in progress during the year.

Specifications were prepared and proposals invited for the construction of a breakwater beginning at the 6-foot curve off Long Beach Point and extending thence southwardly, in accordance with project for expenditure of the available funds approved by the Secretary of War April 18, 1899. The proposals were opened June 12, 1899, and the lowest bid received for the work, at 43 cents per gross ton in place, was accepted.

PRESENT CONDITION OF IMPROVEMENT.

The only public work done in this harbor is the beginning of construction of two breakwaters. Umbrella Breakwater has been made 74 feet long and Huron Breakwater 64 feet long. Both were begun upon the rocks and were built to 10 feet above low water, with top width of 4 feet, the outer ends being slightly higher to serve as beacons on the rocks. At their present lengths they serve no other purpose than to mark the rocks.

PROPOSED OPERATIONS.

It is proposed to construct so much of the breakwater as the available funds will permit.

Larchmont Harbor is in the collection district of New York. The nearest lighthouse is on Execution Rock, about 4 miles south. The nearest works of defense are the fortifications on Davids Island, New York, 5 miles to the south-southwest.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$50,000.00
June 30, 1899, amount expended during fiscal year	34.93
July 1, 1899, balance unexpended	49,965.07
Amount (estimated) required for completion of existing project	58,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improving Larchmont Harbor, New York: $5,000 by act of September 19, 1890; $50,000 by act of March 3, 1899.

Abstract of proposals for building riprap breakwater at Larchmont Harbor, Long Island Sound, received in response to advertisement dated May 12, 1899, and opened June 12, 1899, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers.

No.	Name and address of bidder	Price per ton of 2,240 pounds.	Amount on 104,000 tons.
		Cents.	
1	Stacy B. Opdyke, jr., 1222 Belmont avenue, Philadelphia, Pa	49	$50,960
2	John Beattie, Leete Island, Conn	99	102,960
3	Alex. Crawford Chenoweth, 41 East Fifty-ninth street, New York City	98	101,920
4	Samuel E. Bouker, 110 Wall street, New York City	89	92,560
[a] 5	Charles Frey, jr., 411 Fourth avenue, New York City	43	44,720
6	Eugene S. Belden, 217 Laurel street, Hartford, Conn	87	90,480
7	Hughes Bros. & Bangs, Syracuse, N. Y	84	87,360
8	The Hudson Contracting Co., 2515 Broadway, New York City	93½	97,240

[a] Lowest bid.

No contract for this improvement has been in force during the past fiscal year.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Number of vessels other than yachts entering harbor of refuge, or for the night, during 1898 (estimated)		300
Draft of such vessels	feet	4 to 12
Tonnage of such vessels	tons	10 to 500

Freight discharged in Larchmont Harbor in 1898.

Number of cargoes	75
Amount in tons	4,500

Vessels owned by the Larchmont Yacht Club.

[Draft, from 3 to 19 feet; tonnage, from 3 to 600 tons; total tonnage, 4,500 tons.]

Steamers	64
Schooners	38
Sloops	95
Smaller boats	104
Total	301

No new lines of transportation are reported as established since July 1, 1898.
The amount of freight reported above is 2,500 tons more than reported for 1891.

E 4.

IMPROVEMENT OF EAST CHESTER CREEK, NEW YORK.

East Chester Creek is a small tidal stream which empties into Long Island Sound just east of Throgs Neck and 20 miles by water from the Battery, New York City.

PROJECTS FOR IMPROVEMENT.

In 1873 a project for improvement was adopted, which has since been modified, and consists in making a channel 100 feet wide and 9 feet deep at mean high water (about 2 feet at low water), extending from Pelham Bay up the stream to 3,000 feet above Lockwoods, and in removing rocky obstructions from the mouth of the creek.

The project is considered completed. The banks of the cut are considerably disturbed by boats navigating the dredged channel, and dredging will be required from time to time to maintain the improvement.

A detailed description of the stream and of the project for improvement is printed in the Annual Report of the Chief of Engineers for 1897, pages 1089–1090.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done.

PRESENT CONDITION OF IMPROVEMENT.

The channel has been made 9 feet deep at mean high water and about 100 feet wide from Pelham Bridge to a point 3,000 feet above Lockwoods. It is in good condition.

The dikes on the east side of the cut below Lockwoods, built in 1877–78, show some deterioration. No repair is necessary at present.

PROPOSED OPERATIONS.

Future appropriations should be applied to maintaining the improved channel.

East Chester Creek, New York, is in the collection district of New York. The nearest light-house is on the "Stepping Stones," 3 miles southeast of the mouth of the creek. The nearest work of defense is Fort Schuyler, Throgs Neck, about 3½ miles south.

Money statement.

July 1, 1898, balance unexpended	$1,010.90
June 30, 1899, amount expended during fiscal year	1.40
July 1, 1899, balance unexpended	1,009.50
July 1, 1899, balance available	1,009.50
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Appropriations for improving East Chester Creek have been made as follows:

Application.	Date.	Amount.
Cutting through marsh and rock and diking (in 1877)	Mar. 3, 1873	$25,000
Dredging under Boston Road Bridge and at Goose Island	Mar. 3, 1875	12,000
Dredging near Lockwoods, Goose Island, and Pelham Bridge	June 18, 1878	10,000
Dredging, from 40 to 90 feet wide, from Pell Point to Town Dock	Mar. 3, 1879 June 14, 1880	3,500 3,500
Dredging above Town Dock	Aug. 5, 1886	10,000
Dredging above Lockwoods	Aug. 11, 1888	5,000
Do	Aug. 18, 1894	12,000
Dredging	June 3, 1896	10,000
Total		91,000

No contract in force during fiscal year ending June 30, 1899.

COMMERCIAL STATISTICS.

A statement of commerce for the calendar year 1898 has been asked for, but not yet received. Following are the commercial statistics reported for the calendar year 1896:

Arrivals and departures of vessels.

[Draft, 6 to 10 feet; tonnage, 200 to 300 tons.]

Steamers	544
Sail vessels	27
Barges	230
Total	801

Freight received and shipped by water.

Articles.	Tons.	Estimated value.
Coal	16,878	$84,390
Building materials	7,580	50,900
Miscellaneous steamer freights, ashes, asphalt, crushed stone, etc	70,470	2,063,896
Total	94,928	2,199,186

No new lines of transportation are reported as established since July 1, 1898.

E 5.

IMPROVEMENT OF BRONX RIVER, NEW YORK.

The Bronx River is a small stream which flows southwardly through Westchester County and discharges into the East River, New York, about halfway between Hell Gate and Throgs Neck. For the lower 3 miles of its course, from West Farms to the mouth, the river is a tidal stream, navigable at high water. This part of the Bronx River lies wholly within the boundaries of New York City. Excepting a small bay at the mouth, the stream is everywhere narrow, with widths ranging from 50 to 300 feet. The natural depth in the bay is about 4 feet at mean low water, decreasing to 1 foot or less at the West Farms Docks. A short distance above these docks there is a dam which wholly limits navigation.

The navigable part of the river is crossed by two bridges, both with draws; the lower one is a highway bridge, about 2¼ miles above the mouth of the bay; 600 feet above is the bridge of the New York, New Haven and Hartford Railroad, Harlem River branch.

The mean rise of tide in the bay is 6.6 feet; at West Farms it is 5.9 feet.

PROJECT FOR IMPROVEMENT.

The river and harbor act of 1880 provided for a survey of the Bronx River. The report on the survey presented plans for making a channel 30 feet wide and 4 feet deep, at an estimated cost of $42,000. No appropriation was made for beginning work.

A survey of the Bronx River was again made in compliance with the provisions of the river and harbor act of 1890, the report upon which, printed in the Annual Report of the Chief of Engineers for 1891, page 951, presented a project for improvement which was adopted under the terms of the river and harbor act of 1896. This project consists in dredging and removal of rock to make a navigable channel 4 feet deep at mean low water, to be 100 feet wide from the entrance (Strain place) to Barlow street, thence to Dongan street to be 60 feet wide, and thence to the head of navigation at West Farms to be 50 feet wide, at an estimated cost of $85,985.

By act of Congress approved March 3, 1899, an appropriation of $20,000 was made, which will be applied in making a survey of the rocky obstructions in the river between the New York, New Haven and Hartford Railroad bridge and the head of navigation at West Farms and in deepening the channel in accordance with the approved project.

Harbor lines in the bay at the mouth of Bronx River were established by the Secretary of War January 9, 1891.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

By act of Congress of March 3, 1899, $20,000 was appropriated for continuing this improvement, and in compliance with Department letter of March 10, 1899, a project for expenditure of the funds was submitted under date of March 14, 1899, and approved by the Chief of Engineers March 17, 1899. This project provided for making a survey of rocky obstructions in the channel at a cost not exceeding $500, and for dredging or rock removal after the survey had been plotted and the condition of the river more fully understood. Up to the close of the year ending June 30, 1899, the survey had been made and the plotting of same was completed.

PRESENT CONDITION OF IMPROVEMENT.

Three ledges lying within the 50-foot channel have been removed, from a point 1,300 feet below to 350 feet above the Westchester Avenue Highway Bridge, except immediately under and close to the bridge, making a depth of 6 feet at mean low water, where rock was found less than the projected depth of 4 feet. The channel depth up to that point, where the bottom is muddy, is about 3 feet. Above the railroad bridge, where no work has been done, the channel depth is from zero to 2½ feet.

PROPOSED OPERATIONS.

The appropriation now available will be applied to the removal of the worst rock obstructions in the 50-foot channel, and future appropriations should be applied to the completion of the work contemplated under the adopted project.

The Bronx River is in the collection district of New York. The nearest light-house is on North Brother Island, about 2 miles west from the mouth of the river. The nearest work of defense is Fort Schuyler, Throgs Neck, New York.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$20,000.00
June 30, 1899, amount expended during fiscal year..........................	213.48
July 1, 1899, balance unexpended	19,786.52
Amount (estimated) required for completion of existing project	55,985.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improving Bronx River, New York: $10,000 by act of June 3, 1896; $20,000 by act of March 3, 1899.

No contract for this improvement was in force during the fiscal year ending June 30, 1899.

COMMERCIAL STATISTICS.

No data regarding commerce for the calendar year 1898 has yet been received. Following are the commercial statistics reported for the calendar year 1897:

Arrivals and departures of vessels.

[Draft, 4 to 6 feet; tonnage, 85 to 300 tons.]

	Number.
Steamers	6
Tugs	1,350
Sail vessels	68
Barges, etc	607
Total	2,031

Freight received by water (no shipments).

Articles.	Tons.	Estimated value.
Coal	65,500	$241,750
Lumber	5,700	48,700
Building materials	54,380	183,150
Ice	12,000	30,000
General merchandise	1,730	22,425
Total	139,310	526,025

The above figures show an increase over the amount of freight reported for 1896 of 45,066 tons.

No new lines of transportation are reported as established since July 1, 1898.

E 6.

IMPROVEMENT OF MATTITUCK HARBOR, NEW YORK.

Mattituck Harbor is a tidal inlet on the north shore of Long Island, about 70 miles east from New York City.

PROJECT FOR IMPROVEMENT.

Under the river and harbor act of 1896 a project for improvement was adopted which consisted in making a channel to be 7 feet deep at mean low water and 100 feet wide at the entrance, thence to the mill-dam 80 feet wide, and extending it to the Mattituck village with a depth of 7 feet at high water and a width of 80 feet, the entrance channel to be protected by parallel jetties, at a total estimated cost of $83,000.

No work has yet been done under this project.

Further details as to this harbor and the project for improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1095, and for 1891, page 843.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Nothing has been done. The first work necessary under the project for this improvement is the construction of the parallel jetties to protect and fix the shifting channel. The construction of these two jetties was estimated to cost about $40,000, and the available funds would be sufficient to build about three-fourths of either, from which no benefit to navigation would result. Therefore, with approval of the Secretary of War, dated February 12, 1897, and March 20, 1899, the project for the application of the funds provided for Mattituck Harbor was modified to permit of their retention until a sufficient sum is appropriated to complete at least one of the jetties.

PROPOSED OPERATIONS.

For the reason above stated no work is at present proposed.

Mattituck Harbor is in the collection district of New York. The nearest lighthouse is on Hortons Point, about 8 miles to the northeast. The nearest work of defense is Fort Hale, New Haven Harbor, Connecticut, about 25 miles northwest.

Money statement.

July 1, 1898, balance unexpended	$10,000.00
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	15,000.00
July 1, 1899, balance unexpended	15,000.00
Amount (estimated) required for completion of existing project	68,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improving Mattituck Harbor, New York: $10,000 by act of June 3, 1896; $5,000 by act of March 3, 1899. No expenditures have been made from these amounts.

No contract in force during the past fiscal year.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

No statement of amount of tonnage of freights by water has been received. The harbor in its present condition is navigated only by boats of very light draft, and even this is done with difficulty.

The greater part of the freighting to and from Mattituck, estimated at about 100,000 tons in 1896, is done by rail.

E 7.

IMPROVEMENT OF PORT JEFFERSON HARBOR, NEW YORK.

Port Jefferson Harbor is on the north shore of Long Island and about 50 miles east from New York City.

PROJECTS FOR IMPROVEMENT.

In 1871 a project was adopted under which, in 1883, a channel 100 feet wide and 8 feet deep at mean low water had been dredged through the inlet, and riprap jetties had been built to protect the channel on either side, at a total cost of $79,000.

In 1890 a project was adopted for enlarging the jetties and dredging the channel 200 feet wide and 10 feet deep; this was modified to provide for 12 feet depth by the terms of the river and harbor act of 1894. Estimated cost, $145,000.

The appropriation of $7,500 made by act of Congress approved March 3, 1899, will be applied to enlarging and strengthening the jetties in accordance with the approved project.

Detailed description of the harbor and of the projects for improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1097.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations were in progress during the year.

PRESENT CONDITION OF IMPROVEMENT.

The east jetty is 1,390 feet long, part of the shore end being covered by sand which has drifted in; it is 6 feet above high-water level, and approximately 4 feet wide on top. The west jetty is 940 feet long; the outer 250 feet has been built up to about 4 feet above high water, with 4 feet top width; the inner part is about 2 feet above low water. Both jetties are rough and in an unfinished condition; they require building up, trimming, and filling out the side slopes.

The dredged channel, made 240 feet wide and 10 feet deep, has shoaled on the east side at the inner end and is now about 200 feet wide. The 12-foot channel, now 160 to 180 feet wide, lies within and on the west side of the 10-foot channel.

PROPOSED OPERATIONS.

With the available funds it is proposed to enlarge and strengthen the jetties.

Port Jefferson is a port of delivery in the collection district of New York. There is a light-house on Old Field Point, 1½ miles west of the harbor entrance. Fort Hale, New Haven Harbor, Connecticut, 23 miles distant, is the nearest work of defense.

Money statement.

July 1, 1898, balance unexpended		$779.21
Amount appropriated by river and harbor act approved March 3, 1899		7,500.00
		8,279.21
June 30, 1899, amount expended during fiscal year		6.69
July 1, 1899, balance unexpended		8,272.52
Amount (estimated) required for completion of existing project		87,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$25,000.00	
For maintenance of improvement	8,000.00	
		33,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Port Jefferson Harbor have been made as follows:

Application.	Date.	Amount.
For previous projects:		
East jetty	Mar. 3, 1871 June 10, 1872	$15,000 15,000
East and west jetties	Mar. 3, 1875	15,000
East jetty and dredging	Aug. 14, 1876	6,000
East and west jetties	June 18, 1878	8,000
Dredging	Mar. 3, 1879	5,000
East and west jetties	June 14, 1880	3,000
East jetty	Mar. 3, 1881 Aug. 2, 1882	4,000 8,000
Total for the previous projects		79,000
For the present project:		
Enlarging jetties and dredging	Sept. 19, 1890	25,000
Dredging 10 feet deep	July 13, 1892	10,000
Dredging 12 feet deep	Aug. 18, 1894	7,500
Dredging 12 feet deep	June 3, 1896	7,500
Enlarging and strengthening jetties	Mar. 3, 1899	7,500
Total for present project		57,500
Total amount appropriated for this harbor since 1871		136,500

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

Articles.	Tons.	Estimated value.
Receipts:		
Coal	7,240	$26,000
Lumber	2,000	30,000
Building materials	900	18,000
Grain	9,800	101,200
General merchandise	1,500	125,000
Total	21,440	300,200
Shipments:		
Flour	1,300	50,000
Farm produce	2,200	10,000
Total	*a* 3,500	60,000

Vessels engaged in above commerce.

Class.	Number of round trips.	Tonnage.	Draft.
		Tons.	*Feet.*
Steamers	*a* 710	10 to 1,100	3 to 15
Sailing vessels	*a* 450	15 to 1,250	4 to 14
Barges, etc	35	100 to 250	4 to 8

a About.

No new lines of transportation are reported as established since July 1, 1898.

The freight carried in 1898 is slightly less than that reported for 1897, but its value has increased nearly $80,000.

E 8.

IMPROVEMENT OF HUNTINGTON HARBOR, NEW YORK.

Huntington Harbor is on the north shore of Long Island, and about 40 miles east from New York City.

PROJECTS FOR IMPROVEMENT.

In 1872 a project was adopted under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings.

In 1884 this channel had completely filled up.

In 1890 a project was adopted for restoring and maintaining this channel, at an estimated cost of $32,000.

The appropriation of $7,500, made by act of Congress approved March 3, 1899, will be applied to removing shoals and widening the channel.

Detailed descriptions of the harbor and of the projects for improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1100, 1101.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations were in progress during the year.

A contract for dredging 48,500 cubic yards of material was entered into with the DuBois Brothers Dredging Company on May 24, 1899.

PRESENT CONDITION OF IMPROVEMENT.

The dredged channel has been made 175 feet wide up to the bend at the old town dock, 230 feet wide at the bend, and about 100 feet wide for about 200 feet above the bend, the width over 100 feet being made for purposes of maintenance in lieu of piling; the depth made has been 8 feet below mean low water.

PROPOSED OPERATIONS.

The channel will be widened, and shoals removed wherever necessary.

Huntington Harbor is in the collection district of New York. The nearest lighthouse is on Eatons Point, at the east side of the mouth of Huntington Bay, about 4 miles distant from the harbor. The nearest works of defense are the fortifications at Willets Point, about 20 miles westward.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...		$7,500.00
June 30, 1899, amount expended during fiscal year..........................		33.43
July 1, 1899, balance unexpended		7,466.57
July 1, 1899, outstanding liabilities	$16.67	
July 1, 1899, amount covered by uncompleted contracts......	6,741.50	
		6,758.17
July 1, 1899, balance available		708.40
Amount (estimated) required for completion of existing project........		2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.		2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Huntington Harbor have been made as follows:

Application.	Date	Amount.
For a previous project:		
Dredging	June 10, 1872	$22,500
For the present project:		
Dredging	Sept. 19, 1890	10,000
Do	July 13, 1892	5,000
Do	Aug. 18, 1894	2,000
Do	June 3, 1896	5,000
Do	Mar. 3, 1899	7,500
Total for present project		29,500
Total for Huntington Harbor, both projects		52,000

Abstract of proposals for dredging in Huntington Harbor, New York, received in response to advertisement dated April 15, 1899, and opened May 15, 1899, by Maj. H. M. Adams, Corps of Engineers.

No.	Name and address of bidder.	Per cubic yard.	Total bid for 48,500 cubic yards.
		Cents.	
a 1	Du Bois Bros. Dredging Co., 19 Whitehall street, New York City	$13\frac{9}{10}$	$6,741.50
2	The Hartford Dredging Co., Hartford, Conn	21	10,185.00
3	The International Contracting Co., Syracuse, N. Y	$14\frac{3}{5}$	7,082.50

a Lowest bid.

CONTRACT IN FORCE.

Name of contractor: Du Bois Brothers Dredging Company.
Date of contract: May 24, 1899.
Date of approval: June 6, 1899.
Date of commencement: July 1, 1899.
Date of completion: August 31, 1899.
Dredging 48,500 cubic yards, more or less, of material, at 13.9 cents per cubic yard.

COMMERCIAL STATISTICS.

A statement of commerce for the calendar year 1898 has been asked for, but not yet received. Following are the commercial statistics reported for the calendar year 1897:

Articles.	Tons.	Estimated value.
Receipts:		
Coal	5,500	$23,000.00
Building material	5,317	94,000.00
Grain	767	13,609.50
General merchandise	6,500	260,000.00
Total	18,084	390,609.50
Shipments:		
Farm produce, etc	a 5,500	82,500.00

a Shipments very uncertain.

Vessels engaged in above commerce.

Class.	Number.	Estimated number of round trips	Tonnage.	Draft.
			Tons.	*Feet.*
Steamers	3	456	125 to 240	6 to 8
Sailing vessels	....	109	50 to 100	7½
Barges, etc	....	3	200	6

The above figures show a total of 23,584 tons, which is less than the amount reported for 1896 by 49,766 tons.

No new lines of transportation are reported as established since July 1, 1898.

E 9.

IMPROVEMENT OF GLENCOVE HARBOR, NEW YORK.

This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island, about 27 miles by water from the Battery, New York City.

PROJECT FOR IMPROVEMENT.

In 1888 a project for improvement was adopted; it was modified in 1895, and now consists in building a breakwater in Hempstead Harbor to shelter the anchorage outside Glencove Harbor, the breakwater to be about 2,000 feet long, 3 feet above high water, with top width of 5 feet. The estimated cost is $135,000.

Further details concerning the harbor and project for improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1103.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work of construction has been done.

A red light has been maintained upon the outer end of the uncompleted breakwater.

PRESENT CONDITION OF IMPROVEMENT.

The breakwater is now 1,465 feet long, with 3 feet top width at a level of 4 feet above mean high water. It has settled in some places. The work contains about 80,580 tons of riprap.

At its present length the breakwater affords a shelter to vessels waiting for tide to enter Glencove Harbor, and also to local commerce at Glencove Dock.

The project is about one-half completed.

PROPOSED OPERATIONS.

Future appropriations should be applied to the extension of the breakwater under the adopted project.

Glencove Harbor is in the collection district of New York. The nearest lighthouse is on Sands Point, about 4 miles west. Fort Schuyler, New York Harbor, is the nearest work of defense.

Money statement.

July 1, 1898, balance unexpended	$365.06
June 30, 1899, amount expended during fiscal year	201.00
July 1, 1899, balance unexpended	164.06
July 1, 1899, outstanding liabilities	16.00
July 1, 1899, balance available	148.06
Amount (estimated) required for completion of existing project	72,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Glencove Harbor, New York, have been made as follows:

Application.	Date.	Amount.
Breakwater construction	Aug. 11, 1888	$20,000
Do	Sept. 19, 1890	15,000
Do	July 13, 1892	10,000
Do	Aug. 18, 1894	10,000
Do	June 3, 1896	8,000
Total		63,000

No contract for this improvement has been in force during the fiscal year ending June 30, 1899.

COMMERCIAL STATISTICS.

A statement of commerce for the calendar year 1898 has been asked for, but not yet received. Following are the commercial statistics reported for the calendar year 1897:

Arrivals and departures of vessels.

[Draft, 4½ to 7½ feet; tonnage, 20 to 330 tons.]

Kind of vessel.	Number of round trips.	Aggregate tonnage of all trips.
Steamers, steam tugs, and yachts	1,855	277,405
Sailing vessels	175	29,750
Barges	624	93,600
Total	2,654	400,755

Freight received and shipped by water.

Chief articles.	Tons.	Estimated value.
Receipts:		
Coal	15,000	$60,000
Corn	50,400	720,000
Building materials, lumber, barrels, etc	150,000	105,000
Miscellaneous	185,000	1,447,000
Total		2,332,000
Shipments:		
Starch, glucose, etc	165,000	2,698,000
Miscellaneous	168,000	1,269,000
Total		3,967,000
Total receipts and shipments	733,400	6,299,000

The report for 1897 shows 626,965 tons more freight than was reported in 1896. No new lines of transportation have been established since July 1, 1898.

E 10.

IMPROVEMENT OF FLUSHING BAY, NEW YORK.

Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City.

PROJECT FOR IMPROVEMENT.

In 1879 a project for this improvement was adopted, which, as since modified, consists in building a dike 4,663 feet long on the west side of the channel and in making and maintaining a channel 6 feet deep at mean low water up to the lower bridge at Flushing, at an estimated cost of $173,500.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done.

PRESENT CONDITION OF IMPROVEMENT.

The dike, 4,663 feet long, is in poor condition. The outer part, 1,606 feet long, which was left partly completed in 1891, has since been nearly destroyed by storms and ice. Further work upon the dike being discontinued, owing to the strong opposition of property owners along the shores of the bay (see Annual Report of the Chief of Engineers for 1892, p. 723), it is not proposed to repair the structure. A small light at the outer (north) end of the dike, maintained by the Light-House Department, prevents that work in its present condition being a serious menace to local navigation.

At completion of last contract, in May, 1897, the channel up to Flushing was in good condition, with an available depth of 6 feet or over at mean low water.

PROPOSED OPERATIONS.

Future appropriations will be applied to dredging to maintain and widen the channel to Flushing.

Flushing Bay is in the collection district of New York. The nearest light-house is on North Brother Island, 3 miles to the northwest. There is a small light on the north end of the dike, in the bay, maintained by the Light-House Department. Fort Schuyler and Willets Point, about 4 miles east from the mouth of the bay, are the nearest works of defense.

Money statement.

July 1, 1898, balance unexpended		$505.87
June 30, 1899, amount expended during fiscal year		1.40
July 1, 1899, balance unexpended		504.47
Amount (estimated) required for completion of existing project		50,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	5,000.00	
		15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Flushing Bay, New York, have been made as follows:

Application.	Date.	Amount.
Construction of dike	Mar. 3, 1879	$20,000
Dredging	June 14, 1880	15,000
Do	Mar. 3, 1881	10,000
Do	Aug. 2, 1882	5,000
Do	July 5, 1884	10,000
Do	Aug. 5, 1886	10,000
Construction of dike and dredging	Aug. 11, 1888	15,000
Repair of dike and dredging	Sept. 19, 1890	20,000
Dredging	July 13, 1892	10,000
Do	Aug. 18, 1894	4,000
Do	June 3, 1896	4,000
Total	....	123,000

No contract for this improvement has been in force during the past fiscal year.

COMMERCIAL STATISTICS.

A statement of commerce for the year 1898 has been asked for, but not yet received. Following are the commercial statistics reported for the calendar year 1897:

Freight received and shipped by water.

Articles.	Tons.	Estimated value.
Receipts:		
Coal	32,109	$135,872
Building materials	12,670	63,525
Paving materials *a*	73,566	91,691
Farm produce	20,000	57,250
Dyewoods	8,000	240,000
Miscellaneous	12,800	136,100
Total	159,145	724,438
Shipments:		
Logwood extracts	3,250	650,000
Miscellaneous	1,000	75,000
Total	4,250	725,000

a Unusual amount of paving done in 1897.

Vessels engaged in above traffic.

Class.	Number of round trips.	Tonnage.	Draft, loaded.
		Tons.	*Feet.*
Steamers	304	100 to 156	7 to 7½
Tugs	1,022	....	....
Sail vessels	157	150 to 450	6 to 14
Barges, etc	354	100 to 700	6 to 10
Total	1,837	....	....

The total tonnage of freights reported for 1897, 163,395 tons, is 82,575 tons greater than the amount reported for 1896.

No new lines of transportation are reported as established since July 1, 1898.

E II.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

East River is the designation of the tidal strait which extends from the Battery to Throgs Neck, a distance of 16 miles, and connects New York Harbor with Long Island Sound. It is the harbor entrance used almost exclusively by the coasting trade between New York City and the New England States, and British American provinces.

The channel in places is crooked and narrow, and was originally obstructed by many rocks and reefs, over and around which the tide ran in strong eddying currents, with velocities at times as high as 6 miles per hour; even 10 miles has been recorded at single points. The most dangerous of these places is that known as Hell Gate, where the channel turns a right angle around Hallets Point, and where it was originally obstructed by several reefs, some bare at low tide, and others covered from 1 to 20 feet deep.

The mean rise of tide in East River below (south of) Hell Gate is 4½ to 5 feet; east of Hell Gate, where it is affected by the Long Island Sound tides, it is from 5 to 7 feet.

PROJECTS FOR IMPROVEMENT.

The project for improvement, adopted in 1867 and subsequently modified, provides for removal to a depth of 26 feet below mean low water of the following rocks in and near Hell Gate, viz: Hallets Point Reef (3 acres), Way Reef, Shell Drake, Pot Rock, Frying Pan, Heel Tap, Negro Point, Scaly Rock, and Middle Reef (which includes Flood Rock, Gridiron, Hen and Chickens, and Negro Heads), and of the following rocks south of Hell Gate: Ferry Reef and Charlotte Rock, off Thirty-fourth street, to 26 feet depth; Pilgrim Rock, off Nineteenth street, to 24 feet depth; Shell Reef, off Ninth street, to 18 feet depth; Coenties Reef and Diamond Reef, near the south end of East River, to 24 feet depth, and reef off Diamond Reef to 26 feet depth; and of the following, east of Hell Gate, viz: Reef off Sunken Meadow to 18 feet depth; North Brother Island Reef to 26 feet depth, and reef off Baretto Point to 24 feet depth; also for the building of four sea walls upon other ledges to guide the course of the tidal currents. The total estimated cost was $5,139,120.

By act of Congress approved March 3, 1899, the removal of Man-o'-war Rock was included in the project.

The estimated cost of removing this rock to a depth of 26 feet, mean low water, was $500,000.

July 1, 1898, the following rocks had been removed to the required depth, viz: Hallets Point Reef, Way Reef, Shell Drake, Scaly Rock, Charlotte Rock, Pilgrim Rock, Coenties Reef, Diamond Reef, reef off Diamond Reef, North Brother Island Reef, and reef off Baretto Point. Shell Reef had been removed to the required depth, except at a few points; Middle Reef had been removed to 18-20 feet, Flood Rock being blasted to the required depth, but not entirely removed; Pot Rock, Frying Pan, and Heel Tap to 18-22 feet; Ferry Reef to 24 feet, and reef off Sunken Meadow to nearly the required depth. No work had been done upon Negro Point. A dike had been built between Great and Little Mill Rocks, Hell Gate, since used as a place for storing public materials and for laying up public vessels.

Further detailed descriptions of the locality, projected work, and work done, are printed in the Annual Reports of the Chief of Engineers—

	Page.
For 1868	741
For 1874, Part II	164
For 1897	1026

Modifications in harbor lines between East Twenty-third and East Twenty-fourth streets; at Oak Point, East River; and on the westerly shore of East River, at Rikers Island, were approved by the Secretary of War on April 17, April 19, and May 15, 1899, respectively.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Plant laid up and cared for at Mill Rock.

By act of Congress of March 3, 1899, $250,000 was appropriated for continuing the improvement, including the removal of Man-o'-War Rock, East River.

In compliance with Department letter of March 10, 1899, a project for the expenditure of the appropriation was submitted, and was approved by the Secretary of War March 20, 1899. This project provides for making a survey of Man-o'-War Rock and for its removal. During the month of April, 1899, a survey of Man-o'-War Rock was made and specifications prepared for its removal to 26 feet depth at mean low water. After duly advertising, proposals were opened on June 3, and the acceptance of the bid of the R. G. Packard Company was authorized by the Chief of Engineers June 9, 1899. A contract for the removal of the rock to the required depth for the sum of $159,000 has been prepared and forwarded for approval.

PRESENT CONDITION OF IMPROVEMENT.

The following table shows the rocks and reefs to be removed under the adopted project, with their distance from the Battery, and the original, present, and projected depths for each:

	Distance from the Battery.	Least original depth.	Least present depth.	Projected depth.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Feet.*	
Diamond Reef	⅛	17	26	24	Completed.
Reef off Diamond Reef	¼	19	26	26	Do.
Coenties Reef	⅛	14.3	25.5	24	Do.
Shell Reef, off 9th street	3½	7.5	*a* 18	18	
Pilgrim Rock, off 19th street	4	12	24	24	Do.
Ferry Reef, off 34th street	4¼	7	24	26	
Charlotte Rock, off 34th street	4½	14.7	26.5	26	Do.
Man-o'-War Rock	4¾	+ 0.8	+ 0.8	26	Work not commenced.
Middle Reef, including Flood Rock, Gridiron, Hen and Chickens, and Negro Heads.	7	+ 6	18 to 20	26	
Hallets Point	7¼	+ 4	26	26	Completed.
Heel Tap	7⅛	12.1	20.5	26	
Frying Pan	7½	11	18	26	
Pot Rock	7¼	20	22.8	26	
Way Reef	7⅛	17.4	26	26	Do.
Shell Drake	7½	18.3	26	26	Do.
Scaly Rock	7¼	....	26	26	Do.
Negro Point	7⅛	....	....	26	
Reef off Sunken Meadow	9	11	17.8	18	Nearly completed.
North Brother Island Reef	10	16	26	26	Completed.
Reef off Baretto Point	11	17	24	24	Do.

a Nearly.

The depth proposed in the original project was 24 feet below mean low water. Subsequently the projected depth was increased to 26 feet for all the rocks in and near Hell Gate and for some of the others.

Shell Reef and reef off Sunken Meadow are large reefs not directly in the main channel. When the project was extended to include work upon these, their proposed depth was placed at 18 feet.

PROPOSED OPERATIONS.

With the available funds it is proposed to remove Man-o'-War Rock to a depth of 26 feet below mean low water, and other rocky obstructions as contemplated by the approved project.

Money statement.

July 1, 1898, balance unexpended	$1,547.49
Amount appropriated by river and harbor act approved March 3, 1899	250,000.00
	251,547.49
June 30, 1899, amount expended during fiscal year	3,448.40
July 1, 1899, balance unexpended	248,099.09
July 1, 1899, outstanding liabilities	149.60
July 1, 1899, balance available	247,949.49
Amount (estimated) required for completion of existing project	1,003,840.67
Amount that can be profitably expended in fiscal year ending June 30, 1901	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

Act of—		Act of—	
July 25, 1868	$85,000.00	August 2, 1882	$200,000.00
April 10, 1869	178,300.00	July 5, 1884	360,000.00
July 11, 1870	250,000.00	August 5, 1886	112,500.00
March 3, 1871	250,000.00	August 11, 1888	250,000.00
June 10, 1872	225,000.00	September 19, 1890	200,000.00
March 3, 1873	225,000.00	July 13, 1892	150,000.00
June 23, 1874	225,000.00	August 18, 1894	75,000.00
March 3, 1875	250,000.00	June 3, 1896	60,000.00
August 14, 1876	250,000.00	March 3, 1899	250,000.00
June 18, 1878	350,000.00	Net receipts from other sources	3,637.88
March 3, 1879	250,000.00		
June 14, 1880	200,000.00	Total	4,649,437.88
March 3, 1881	200,000.00		
May 4, 1882	50,000.00		

Deduct amount reverted to United States Treasury	$3,158.55	
Deduct amount allotted to Harlem River	11,000.00	
		14,158.55
		4,635,279.33
Amount expended to June 30, 1899		4,387,180.24

Abstract of proposals for excavation and removal of Man-o'-War Rock, East River, New York Harbor, received in response to advertisement dated May 3, 1899, and opened June 3, 1899, by Maj. H. M. Adams, Corps of Engineers.

No.	Name and address of bidder.	Price for removal, in lump sum.
1	P. Sanford Ross (Incorporated), 277 Washington street, Jersey City, N. J	$246,500.00
2	George A. Rogers, Plattsburg, N. Y	284,520.00
3	F. W. Dashe, Arlington, N. J	240,000.00
4	R. G. Packard Co., 130 Pearl street, New York City [a]	159,000.00
5	Dunbar & Sullivan, Buffalo, N. Y	199,000.00
6	Sherly Onderdonk, 1 Broadway, New York City	169,763.30

[a] Lowest bid.

CONTRACT IN FORCE.

Name of contractor: R. G. Packard Co.
Date of contract: June 21, 1899.
Date of approval: July 13, 1899.
Date of commencement: On or before September 11, 1899.
Date of completion: On or before March 11, 1901.

Excavation and removal of Man-o'-War Rock to a depth of 26 feet below mean low water for the lump sum of $159,000.

COMMERCIAL STATISTICS.

The commerce of the East River is so intimately connected with that belonging to New York Harbor proper that it is impracticable to make a separate statement of it.

E 12.

IMPROVEMENT OF HARLEM RIVER, NEW YORK.

Harlem River and Spuyten Duyvil Creek are two tidal inlets, from the East River and Hudson River, respectively, which joined at Kings Bridge and separated Manhattan Island from the mainland to the north.

The Harlem River had a natural fair channel 10 feet deep at low water from the East River, near Hell Gate, to Morris Dock, a distance of 5 miles, except at High Bridge, where the depth was reduced to 6 feet by the débris of stone, etc., carried into the river during the construction of the bridge; for a mile farther, to Fordham Landing, it had a crooked channel of 7 feet depth; above Fordham Landing, to Kings Bridge, a farther distance of about a mile, the channel was too narrow and crooked to be used by any but the smallest class of boats. From Kings Bridge to the Hudson River, a distance of 1¾ miles, Spuyten Duyvil Creek had a natural available depth of about 4 feet at low water. At Kings Bridge the channel between the two inlets was very narrow and nearly cut off by a ledge of rocks, awash at low tide.

The mean rise of tide in the Harlem River was from 5.5 to 6 feet; in Spuyten Duyvil Creek it was 3.8 feet. Mean high-water level in the Hudson River at Spuyten Duyvil Creek was nearly a foot lower and one hour and forty minutes earlier than in the Harlem River.

PROJECT FOR IMPROVEMENT.

This project, adopted in 1875 and subsequently modified, consists in making a navigable channel between the East and Hudson rivers, by way of Harlem River and Spuyten Duyvil Creek, cutting off the sharp bend at Kings Bridge by a canal through Dyckman Meadow, the width of channel to be 350 to 400 feet, and the depth at mean low water to be 15 feet, except through Dyckman Meadow rock cut, where it was to be 18 feet, the work to be done by rock removal and dredging, and the sides of channel to be protected in places by diking or revetment. The estimated cost is $2,700,000.

By act of Congress approved March 3, 1899, the sum of $100,000 was appropriated for "continuing improvement," the act also authorizing and directing the Secretary of War "to take such action as may be most advantageous to the United States regarding the unused stone originally excavated for this improvement, and now stored on leased ground known as Dyckman Meadow, and so much of the appropriation herein made as may be necessary may be used for such purpose."

In compliance with the foregoing, so much of the available funds as may be necessary will be applied to removing the broken stone. The balance it is proposed to use for continuing the improvement, in accordance with the adopted project.

Up to the beginning of the last fiscal year a free channel of 12 to 15 feet depth at mean low water had been made through the entire course between East and Hudson rivers, with 18 feet depth at the Dyckman Meadow rock cut. At this cut the width had been made 350 feet; south and east of it, to the East River, the width was 150 feet or over, and west of it, to the Hudson River, the width was 200 feet or over.

Further detailed descriptions of the locality and projects are printed in the Annual Report of the Chief of Engineers for 1875, Part II, page 224, and for 1887, Part I, page 665.

Harbor lines for Harlem River and Spuyten Duyvil Creek were established by the Secretary of War October 18, 1890, and modified October 2, 1893, and again January 8, 1897.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

At the beginning of the year repairs necessary for the preservation of the drill scow *Hudson* and field survey of the localities worked over during late contracts were in progress. During July, 1898, the repairs of scow were completed and the scow laid up, and the surveys were also completed the same month.

Under the appropriation of $100,000 made by the river and harbor act of March 3, 1899, specifications were prepared and proposals invited for the purchase and removal of the stone stored on land near Spuyten Duyvil, New York city, to be opened April 28, 1899. Ten bids were received, which, with the approval of the Secretary of War May 15, 1899, were all rejected, and the informal offer of John P. Conkling at 22 cents per cubic yard was accepted, and a contract entered into with him May 18, 1899.

Operations under this contract were commenced on June 17, and up to the close of the fiscal year 396 cubic yards of stone had been removed from the stone pile and taken away on a scow.

PRESENT CONDITION OF IMPROVEMENT.

From the Hudson River to Macombs Dam Bridge the improved channel is 12 feet deep and over at mean low water, and from 180 to 350 feet wide. The cut through Dyckman Meadow, originally excavated to a depth of 18 feet, mean low water, has shoaled to 15 feet in some places, owing to the deposit of silt; the width of the cut is 350 feet. From Macombs Dam Bridge south to Wards Island, East River, the available channel is 15 feet deep and over, and nowhere less than 150 feet wide.

To complete the project there remains the widening of the channel to the full width of 350 to 400 feet, deepening it to 15 feet where that depth has not already been obtained, and revetting the banks where the channel excavation passes through meadow or upland.

PROPOSED OPERATIONS.

It is proposed to apply the present appropriation, first, to the removal of stone from Dyckmans Meadows; and, second, to the prosecution of the work most necessary for navigation possible to be done with the funds remaining. Future appropriations will be applied to the continuation and completion of the work contemplated under the adopted project.

Money statement.

July 1, 1898, balance unexpended		$9,991.06
Amount appropriated by river and harbor act approved March 3, 1899.		100,000.00
		109,991.06
June 30, 1899, amount expended during fiscal year		6,976.44
July 1, 1899, balance unexpended		103,014.62
July 1, 1899, outstanding liabilities	$645.45	
July 1, 1899, amount covered by uncompleted contracts	51,612.88	
		52,258.33
July 1, 1899, balance available		50,756.29
Amount (estimated) required for completion of existing project		1,455,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901		500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

Allotment June 23, 1874, from appropriations for East and Harlem rivers	$11,000
Act of March 13, 1875	10,000
Total	21,000

Amounts appropriated under present project.

June 18, 1878	$300,000
March 3, 1879	100,000
August 11, 1888	70,000
September 19, 1890	250,000
July 13, 1892	175,000
August 18, 1894	125,000
June 3, 1896	125,000
March 3, 1899	100,000
Total	1,245,000

Abstract of proposals for the purchase and removal of 235,000 cubic yards, more or less, of broken stone, owned by the United States, and stored on land near Spuyten Duyvil, New York City, received in response to advertisement dated March 25, 1899, and opened April 28, 1899, by Maj. H. M. Adams, Corps of Engineers.

No. of bid.	Name and address of bidder.	Number of cubic yards proposed to be removed.	Time within which it is proposed to do the work.	Price per cubic yard.	Amount.	Approximate money value of rent to be paid by the United States during period of removal of rock.	Total amount, including rent.
				Cents.			
1	Hugh P. Sheridan, 22 State street, New York City.	235,000	18 months....	68	$159,800.00	$3,000.00	$162,800.00
2	The F. W. McNeal Co., 80 and 82 Reade street, New York City.	235,000	300 working days.	34$\frac{97}{100}$	82,179.50	2,000.00	84,179.50
3	John C. Rodgers, 536 West One hundred and fifty-second street, New York City.	235,000	2 years.......	35	82,250.00	4,000.00	86,250.00
4	John P. Conkling, 44 Broadway, New York City.	235,000	300 working days.	38	89,300.00	2,000.00	91,300.00
5	Chas. Frey, jr., 411 Fourth avenue, New York City.	235,000	600 working days.	49½	116,325.00	4,000.00	120,325.00
6	Farrell & Hopper, 215 West One hundred and twenty-fifth street, New York City.	200,000	1 year........	50	100,000.00	2,000.00	102,000.00
7	Manhattan Contracting Co., 39 East Forty-second street, New York City.	235,000	700 working days.	60	141,000.00	4,660.00	145,660.00
8	John A. Bouker, 110 Wall street, New York City.	235,000	500 working days.	30	70,500.00	3,320.00	73,820.00
9	R. G. Packard, 130 Pearl street, New York City.	235,000	4½ years......	39$\frac{7}{10}$	93,295.00	8,500.00	101,795.00
10	James C. Smith, 1080 Broadway, New York City.	235,000	2 years.......	36	84,600.00	4,000.00	88,600.00

All bids rejected, being considered too high.

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

For removal of 235,000 cubic yards, more or less, of broken stone, at 22 cents per cubic yard.

Name of contractor, John P. Conkling.
Date of contract, May 18, 1899; date of approval, May 27, 1899.
Date of commencement, on or before June 17, 1899.
Date of completion, on or before June 11, 1900.

COMMERCIAL STATISTICS.

The actual commerce of the Harlem River and Spuyten Duyvil Creek for the years 1893 and 1895 was as follows:

Items.	1893 (tons).	1895.	
		Tons.	Value.
General merchandise	3,232,052	3,473,581	$171,803,633
Grain, flour, feed, etc	596,306	767,851	15,238,420
Lumber and timber	451,702	633,194	7,839,116
Building material	602,217	1,526,043	4,698,294
Fuel	878,234	947,710	3,776,483
Ice	149,865	185,215	351,430
Total	5,910,376	7,533,594	203,707,376

The total tonnage for the year 1895 shows an increase over that of 1893 of 1,623,318 tons, or nearly 28 per cent, during the two years. Of the total tonnage 4,022,832 tons was received and shipped at the docks of the New York, New Haven and Hartford Railroad Company directly below Second Avenue Bridge, where also about 62,000 passengers were transferred in cars by the steamer *Maryland* to and from the New York, New Haven and Hartford Railroad to and from connecting lines terminating on the Hudson River at Jersey City. Of the balance, 28,101 tons was handled at various points on Spuyten Duyvil Creek, and 3,482,661 tons was received and shipped at the various docks on the Harlem River between its junction with the East River and Dyckman Cut.

As near as can be determined, the vessels engaged in the river traffic were as follows:

Canal boats, barges, and railroad-car floats	37, 246
Sailing vessels, schooners, lighters, etc	5, 483
Steamers and tugs, exclusive of pleasure boats	27, 525

A large proportion of the freight handled at the docks of the New York, New Haven and Hartford Railroad Company is carried in and out of the Harlem River on railroad-car floats and transfer boats; and during the year 1895 335,236 loaded cars and 155,757 empty cars were thus received and shipped from these docks. Only the contents of these cars are included in the above tonnage, not the weight of the cars themselves.

There was also carried out of the river, on scows, 142,650 tons of ashes and other city refuse, which is not included in the above table.

No new lines of transportation were reported as established since July 1, 1898.

The following information regarding commerce on the Harlem River for the calendar year 1898 was furnished by the New York, New Haven and Hartford Railroad Company:

Freight handled at their Harlem River Station.....tons..	4, 358, 576
Passengers carried between Harlem River and Jersey City by transfer steamers	67, 099
Number of loaded cars	420, 021
Number of empty cars	149, 290

Included in the amount of freight handled there were 497,281 tons of coal shipped on through billing.

BRIDGES ACROSS THE HARLEM RIVER.

The following table shows the location and characteristics of the several existing bridges across the Harlem River:

Name and location of bridge.	Width in clear in each draw.	Height of bottom chords above mean high water.	Remarks.
	Feet.	*Feet.*	
First avenue	108	24	Double draw, highway bridge, iron, in course of construction.
Second avenue	103. 7	28. 5	Double draw, railroad bridge, iron.
Third avenue	108	24	Double draw, highway bridge, iron.
Fourth avenue	102	25. 6	Double draw, railroad bridge, iron.
Madison avenue	132	25	Double draw, road bridge, iron.
Macombs Dam, One hundred and fifty-fifth street.	164	28	Do.
New York and Northern Railway Bridge, at Eighth avenue.	128	28	Double draw, railroad bridge, iron.
High Bridge (old aqueduct)	....	....	No draw; stone arch; width between piers, 77.7 feet; clear waterway, 55 feet; crown of arch, 100 feet above mean high water.
Washington Bridge, at One hundred and eighty-first street.	....	Single span.	No draw; iron arch; span, 500 feet; clear waterway, 420 feet; crown of arch, 136.7 feet above mean high water.
Bridge at Broadway across improved channel.	104	26	Double draw, road bridge, iron; opened to traffic Jan. 1, 1895.
Hudson River Railroad Bridge, at the mouth of Spuyten Duyvil Creek.	50	6. 9	Single draw, wooden trestle, iron draw-span; will shortly be replaced by iron truss bridge with double drawspan.
Bridge over Spuyten Duyvil Creek (temporary).	60	7. 26	Lift opening, railroad bridge, iron.
Bridge over Spuyten Duyvil Creek (permanent).	100	[a] 3. 6	Double draw, railroad bridge, iron, in course of construction.

[a] Extreme high tide.

Under authority conferred by the river and harbor acts dated September 19, 1890, August 17, 1894, and June 3, 1896, rules and regulations for the opening and operating of the draws in the bridges crossing the Harlem River were prescribed by the Secretary of War May 14, 1898.

PURCHASE OF CERTAIN LAND NEAR HARLEM RIVER.

[Printed in House Doc. No. 210, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, January 26, 1899.

SIR: Under the first contract for the improvement of Harlem River in 1887 a quantity of stone was excavated from Dyckman Cut, it being intended to use this stone for revetting the sides of the excavated channel of the river. This stone was stored on leased ground, for which the Government has been paying since that time a rental of $2,000 per year.

When the second contract for the work was made in 1889 it became apparent that this stone could not be advantageously used in the improvement of the Harlem River, and, in order to avoid the cost of storage, efforts were made to dispose of the stone by inviting proposals for its purchase. After various efforts, running over a number of years, it was found impossible to sell the stone at any price, and in 1896 signs were prepared and placed in conspicuous places on the stone pile authorizing persons who so desired to take the stone free of cost. A number of applications were made in accordance with this proposition, but only about 2,000 cubic yards was actually taken.

The stone is useful for many purposes, but owing to the abundance of stone of this character in the vicinity, resulting from street grading, excavating of building sites, etc., it has very little value, and consequently all efforts of the Government to get rid of it have failed. It is possible to purchase stone from other parties for less than it would cost to simply remove this from the place where it is stored.

There are no works under way nor projects contemplated in the vicinity of New York upon which this stone could be advantageously used by the Government. A rental of $2,000 per year is now paid for the land upon which it is stored, which amount, and probably more, will have to be paid until some action is taken by Congress. It is believed to be to the public interest to make some arrangement whereby this excessive rental can be avoided.

There are two methods, the adoption of either of which would, in my opinion, be preferable to the existing status:

First, to purchase the land upon which the stone is stored; or, second, to remove the stone and dump it in the deep hole of the Hudson River off Fort Washington Point.

To carry out the first method—that is, the purchase of the land—would require probably an expenditure of about $110,000, as there are 7.33 acres of land and it is valued at about $15,000 per acre.

The second method—that is, the removal of the stone and dumping it in deep water—would cost about $102,000. There are 340,000 tons in all, and it is estimated that the cost of handling and transporting would be about 30 cents per ton, and that it would take about three and one-half years to complete the removal.

It will be seen that there is very little difference between the cost of removing the stone and cost of acquiring title to land upon which it is stored, and it would seem under the circumstances to be more advantageous to the Government to purchase the land if it can be acquired at the price above stated, or somewhere near that price, for the reason that it could undoubtedly be disposed of in the future for a good price, even with the stone left upon it, and whatever amount was secured for it would diminish by that much the total cost to the Government of the disposal of the stone matter.

I have the honor, therefore, to recommend that this matter be brought to the attention of the Committee on Rivers and Harbors of the House of Representatives, with the recommendation that some provision be embodied in the item of appropriation for Harlem River in the current river and harbor bill authorizing the Secretary of War to purchase this land if it can be secured at a reasonable price, or, in the event that it can not be purchased, to cause the stone to be removed and dumped in the Hudson River.

A copy of a memorandum giving a résumé of the action of the Department in regard to this stone is submitted herewith.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

MEMORANDUM OF ASSISTANT ENGINEER A. DOERFLINGER.

1. All the rock stored on the leased ground was excavated from Dyckman Cut under the first contract for this work, dated December 15, 1887, and comprises 235,000 cubic yards, more or less, measured in the dump, equivalent to 340,000 tons, approximately.

2. When the second contract, dated August 12, 1889, for continuing the excavation was made, it was recognized that the storage of the stone would cost more than could ever be realized from it, or more than outside stone could be bought for should it be required in the structure for revetting the sides of the excavated channel, and the contract provided that the excavated stone should become the property of the contractor, and that he must furnish his own place of deposit for it.

3. The first effort to dispose of the stone, or at least a part of it, was made October, 1889, when proposals for the purchase of about 50,000 cubic yards, more or less, of the stone were invited by public advertisement dated October 17, 1889. No bids were received in answer to this advertisement.

4. December 10, 1889, a proposition by John Satterlee, contractor for excavating the rock, for the purchase of 60,000 cubic yards of the stone, at 10 cents per cubic yard, was accepted by this office, but no stone was ever taken under this offer.

5. September 23, 1890, authority was granted to Ross & Sanford, contractors, Jersey City, to take 10,000 tons of the stone free of cost, but no stone was ever taken under this authority.

6. May 18, 1892, E. D. Smith, 88 West Houston street, New York, was authorized to take about 500 cubic yards of the stone, which was subsequently removed by him.

7. April 25, 1894, a letter was addressed by Colonel Gillespie to the Chief of Engineers, requesting authority to sell the stone in small lots, on application, at not less than 10 cents per cubic yard. The authority asked for was granted April 26, 1894.

8. April 27, 1894, proposition of Arthur McMullen & Co., contractors for construction of Broadway Bridge, for the purchase of 1,500 cubic yards of the stone, at 10 cents per cubic yard, was accepted. The stone was subsequently removed from the pile and used as filling of fender pier of Broadway Bridge.

9. December 1, 1894, 2,000 cubic yards of stone were sold to Sherman Petrie, 142 Broad street, New York, at 10 cents per cubic yard; about 1,200 cubic yards of this stone was subsequently removed by the purchaser. December 3, 1894, at the request of Mr. Petrie, the privilege to take stone from the pile at the same price was extended to 20,000 additional cubic yards, but no stone was ever paid for or delivered under this authority.

10. April 6, 1895, Richard Alexander, Marble Hill, New York, was authorized to take 1,000 cubic yards of stone from dump on payment in cash for the stone at the rate of 10 cents per cubic yard. No payment made; no stone delivered.

11. May 29, 1895, all the stone in the dump, 235,000 cubic yards, more or less, again

advertised for sale, bids to be opened July 9, 1895. No bids received under this advertisement.

12. August 28, 1895, Rudolph Holste, 150 Broadway, New York, makes offer to purchase 250,000 cubic yards of the stone at 5 cents per cubic yard. Proposition submitted to the Chief of Engineers and approved by him August 31, 1895. Mr. Holste notified that his offer is accepted September 3, 1895. No payment made and no stone removed under this offer.

13. February 11, 1896, offer of Louis B. Rendt, 129 Broad street, New York, to purchase 3,000 cubic yards, more or less, of stone at 15 cents per cubic yard, was accepted. No payment was ever made under this offer and no stone removed.

14. May 16, 1896, assistant engineer instructed to have proper signs prepared to be placed in conspicuous places upon the stone pile authorizing every person who so desires to take the stone free of cost, after duly applying for permission at the Kings Bridge office.

15. January 14, 1897, Richard Alexander asks for option for sixty days on 50,000 cubic yards of stone at 2½ cents per cubic yard. Mr. Alexander's proposition relative to option not entertained. Informed that he is authorized to take any or all the stone according to advertised terms (free of charge, as stated on signs). No stone taken under this authority.

16. August 24, 1897, pursuant to request of John O'Connor, 3 Beaver street, New York, authority was given him to take 50,000 cubic yards of stone from the dump free of charge, to be removed within one year from date. As no use was made of this permit for two months subsequently, and it became evident that the permit was held only for speculative purposes, it was canceled October 28, 1897.

17. September 21, 1897, permission was given the Hudson River Stone Supply Company to remove from 10,000 to 15,000 cubic yards of stone from the dump, but no stone has been removed under this permit.

18. October 8, 1897, Frank McNeal, contractor for stone riprap wall at Sandy Hook, was authorized to take such stone as he may require to complete his contract for closing the breach in Sandy Hook, N. J. (about 50,000 tons), and the work of removing the stone is now in progress.

19. Under the public notice (by signboards on the stone pile) that every person who so desires may take the stone free of cost there has been removed by Sheridan & Shea, general stone contractors, during the spring of 1897, about 2,000 cubic yards of the stone.

20. About 6,000 cubic yards of the stone has been used in revetments for the sides of the excavated channel; it has been found, however, that even for this purpose stone can be furnished from outside sources at less cost than if taken from the dump.

21. The stone is useful for many purposes, but owing to an abundance of stone in this vicinity resulting from street grading, excavation of building sites, etc., stone of this character can generally be obtained more advantageously from the latter sources by persons requiring it; and consequently all efforts by this office to get rid of the stone in reasonably large quantities without cost to the Government have thus far failed.

22. If the stone is disposed of by dumping it in the deep hole in the Hudson River off Fort Washington Point, as has been suggested by Colonel Ludlow, the cost of handling and transporting the stone would be about 30 cents per ton, or for the whole amount, 340,000 tons, $102,000. On the basis of 10,000 tons per month, it would require thirty-four working months to remove the stone, or, for ten working months per year, about three and one-half years.

23. The depression in the Hudson River off Fort Washington Point has a maximum depth of 155 feet below mean low water. It has a length of 1,000 yards and an average width of 170 yards within the 100-foot contour, or an approximate area of 170,000 square yards. All the stone in the dump could be deposited within this area with an average fill of 1.4 yards, if distributed uniformly over the whole area, or by filling only the deeper portions of the depression it would probably all be contained below the minus 125-foot plane.

A. DOERFLINGER, *Assistant Engineer.*

E 13.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

Newtown Creek is a tidal stream about 4 miles long, extending northerly and westerly through Brooklyn, N. Y., and emptying in the East River opposite Thirty-fourth street.

The mean rise of tide in the creek is about 4½ feet.

PROJECTS FOR IMPROVEMENT.

The first project for improvement, adopted in 1881 and subsequently extended, proposed a channel of varying widths and depths from the mouth of the creek up to the Metropolitan Avenue crossings in both the east and west branches.

By the terms of the river and harbor act of 1896 this project was modified so as to provide for a channel uniformly 125 feet wide and 18 feet deep at mean low water up to the Metropolitan Avenue bridges, at an estimated cost of $450,000.

Up to July 1, 1898, the channel had been made 18 feet deep at mean low water and 125 feet wide from the mouth of the creek to and above Grand Street Bridge over the east branch, and to a point 900 feet up the west branch, except in and close to the draw of the Vernon Avenue, Greenpoint Avenue, and Grand Street bridges, where dredging was postponed to admit of rebuilding or protecting the bridge piers.

Further details of previous projects are printed in the Annual Report of the Chief of Engineers for 1896, pages 760, 761.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

At the beginning of the year dredging was in progress under a continuing contract for the completion of the project entered into with John H. Fenner, of Jersey City, N. J., October 20, 1896.

Dredging and removal of material under this contract were continued until May 30, 1899, when the contract was completed. During the fiscal year the amounts excavated and removed under the contract were 456,637 cubic yards of sand, mud, etc., and 268.76 cubic yards of bowlders, each of one-half cubic yard volume or over. The channel of 18 feet depth at mean low water was extended to 50 feet from the Metropolitan Avenue Bridge on the east branch, and to the pier guard of Metropolitan Avenue Bridge on the west branch, the limits of the project making the full width of 125 feet except through and above Grand Street Bridge on the east branch, where the channel is limited by established harbor lines. Shoals throughout the length of the dredged channel have been removed. The channel has been carefully swept, and all bowlders or hard bottom have been removed to the required depth.

The total amounts of materials dredged under this contract are 1,016,382 cubic yards of sand, mud, etc., and 462.65 cubic yards of bowlders, each of one-half cubic yard volume or over.

The amount of bowlders removed is about one-seventh of the amount estimated (3,200 cubic yards), based upon proportions found in previous work. The amount of sand removed is 51,382 cubic yards more than the amount estimated, due to repeatedly removing shoals along the banks of the channel where it is not bulkheaded.

PRESENT CONDITION OF IMPROVEMENT.

The channel has been dredged 18 feet deep at mean low water, except through the south drawspan of Vernon Avenue Bridge and the southwest drawspan of Greenpoint Avenue Bridge. It has been made 125 feet wide, except through the bridge drawspans and at certain points above Grand Street Bridge, where the established harbor lines are less than that distance apart. On account of the condition of Vernon Avenue and Greenpoint Avenue bridges it has not been safe to dredge in the drawspans. Greenpoint Avenue Bridge is being rebuilt, and an order of the Secretary of War has been issued requiring alterations in Vernon Avenue Bridge.

At the following-named points the banks of the channel are bordered by flats of mud or loose sand, which run into the side cuts immediately after dredging:

At the entrance to the creek from East River.

Immediately below Greenpoint Avenue Bridge.

From Meeker Avenue Bridge to the junction of the east and west branches.

At these points to maintain the required depth over the full width of the channel frequent dredging would be required.

PROPOSED OPERATIONS.

To widen the channel at the entrance, extending it nearly to the harbor lines on either side, or as near as the available funds will permit of.

The estimated cost of maintenance of the improved channel is $10,000 per year. It would be more effective to apply this as $20,000 every two years, and it is probable that the amount of shoaling will decrease as the loose material from adjacent flats is removed, reducing the cost of maintenance.

Newtown Creek is in the collection district of New York, of which New York City is the port of entry. The nearest light-house is on Blackwells Island, New York Harbor. The nearest work of defense is Fort Columbus, Governors Island, New York Harbor.

Money statement.

July 1, 1898, balance unexpended	$122,334.09
June 30, 1899, amount expended during fiscal year	105,683.86
July 1, 1899, balance unexpended	16,650.23
July 1, 1899, outstanding liabilities	66.67
July 1, 1899, balance available	16,583.56
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for Newtown Creek have been made as follows:

Application.	Date.	Amount.
Previous project:		
Dredging below Vernon avenue	June 14, 1880	$10,000
Do	Aug. 2, 1882	15,000
Dredging entrance to Metropolitan avenue	July 5, 1884	20,000
Do	Aug. 5, 1886	37,500
Do	Aug. 11, 1888	25,000
Dredging entrance to Metropolitan avenue and English Kills	Sept. 19, 1890	35,000
Dredging entrance to Metropolitan avenue	July 13, 1892	35,000
Do	Aug. 18, 1894	20,000
Present project:		
Dredging	June 3, 1896	30,000
Do	June 4, 1897	183,000
Total		410,500

CONTRACTS IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Dredging about 965,000 cubic yards of material, at 17⅜ cents per cubic yard, and removing bowlders of one-half cubic yard volume or over, at $8 per cubic yard. Name of contractor, John H. Fenner, of Jersey City, N. J.; date of contract, October 20, 1896; date of approval, October 21, 1896; date of beginning work, November 12, 1896; expiration of contract, under extension, May 31, 1899; contract completed, May 30, 1899.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

These statistics have not yet been received. The following statement, carefully compiled for the year 1897, is believed to represent fairly the annual commerce of the stream:

Freights received and shipped by water.

	Tons.	Estimated value.
Received	2,402,551	$29,596,218
Shipped	825,993	21,850,713
Total	3,228,544	51,446,931

This freight consists of coal, lumber, building materials, petroleum products, chemicals, and miscellaneous goods.

In addition, there were about 420,000 tons of cellar excavations and street cleanings received for filling low lands.

Vessels engaged in above commerce.

Kind of vessel.	Number.	Draft, loaded.	Tonnage.
		Feet.	*Tons.*
Steamers, tugs not included	1,068	6 to 19	120 to 2,250
Sailing vessels	1,768	6 to 19	50 to 3,200
Barges, etc	12,628	6 to 12	100 to 600
Total	15,464		

The above record of freights received and shipped shows an increase of 488,062 tons over the figures reported for 1896.

No new lines of transportation are reported established since July 1, 1898.

E 14.

IMPROVEMENT OF WALLABOUT CHANNEL, NEW YORK.

Wallabout Channel consists of a waterway extending in a half-circle around the inside of the island known as Cob Dock, which lies in Wallabout Bay, off the United States navy-yard at Brooklyn, N. Y., and is a part of the United States property. Wallabout Channel connects with Wallabout Bay east and west of Cob Dock.

Wallabout Bay is a slight indentation of the East River at a point about opposite the navy-yard.

Wallabout Channel is separated into two parts, called the east and west channels, by a stone causeway which connects the mainland with Cob Dock. The east channel, which is about 2,000 feet long and from 250 to 350 feet wide, and had available depths of from 15 to 20 feet along the line of deepest water, diminishing to 5 feet along the sides, is the part now embraced in the approved project for improvement.

The mean range of tide is 4.5 feet.

PROJECT FOR IMPROVEMENT.

Under the terms of the river and harbor act of 1896 a preliminary examination of Wallabout Channel was made, the report upon which was printed in House Doc. No. 122, Fifty-fourth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1897, page 1047. This Report stated that Wallabout Channel is worthy of improvement by the General Government to the extent of increasing the depth of the east channel to 20 feet at mean low water from the entrance to the timber causeway, and that the cost of survey necessary for report and estimates would be $250.

By a joint resolution of Congress approved June 16, 1898, it was resolved:

> That the Secretary of War be, and he is hereby, authorized and directed to submit estimates for work on Wallabout Channel, New York, with a view to secure a depth of twenty feet and a width of three hundred feet at mean low water, from its entrance to the timber causeway, in accordance with the plans heretofore submitted, and that the Secretary of War be, and is hereby, requested to submit his opinion as to the advisability of the proposed improvement.

The sum of $250 was allotted by letter of the Chief of Engineers, dated July 25, 1898, and the duty of making the survey required for estimates was assigned to Maj. H. M. Adams, Corps of Engineers. The survey was made in July and August, 1898, and in his report on same, printed in House Doc. No. 50, Fifty-fifth Congress, third session, it is stated as follows:

> This survey shows that the timber causeway has recently been replaced by a masonry causeway, connecting the island known as Cob Dock with the navy-yard, on a line about 400 feet northeast of the old timber causeway, and also that the minimum width of this channel between the masonry sea wall and the north end of the island and the Brooklyn water front at Division street is 272 feet. To secure a full width of 300 feet would require tearing down this wall for a length of about 300 feet and excavating land above high-water mark now used as part of the navy-yard. This evidently was not contemplated in the report upon preliminary examination, and in my opinion the advantage gained would not compensate for cost and damage to Government property. The channel could be deepened without damage to existing piers, bulkheads, or sea walls, making a width of 300 feet or over, except for about 400 feet length opposite the north end of the island (Cob Dock), where the width would range between 230 and 300 feet. This would be ample for the needs of existing navigation and for such prospective increase in it as can be foreseen.
>
> In connection with the soundings, the bottom was frequently probed with an iron rod, and no material harder than sand was found.
>
> The cost of this work is estimated as follows:
>
> | | |
> |---|---|
> | Dredging 183,000 cubic yards of sand, mud, etc. (scow measurement), at 20 cents per yard | $36,600 |
> | Supervision, etc., about 10 per cent | 3,400 |
> | Total | 40,000 |
>
> To excavate land above high water, removing and replacing the masonry sea wall in such way as to make the channel opposite the north end of the island 300 feet wide, would add about $25,000 to the above cost, independent of damage to property, and would result in no corresponding benefit to navigation.
>
> In my opinion Wallabout Channel is worthy of improvement by the United States for the reasons stated in the report upon the preliminary examination, to the extent of making it 20 feet deep at mean low water from the entrance to the vicinity of the new masonry causeway, with widths ranging from 230 to 350 feet—as great as can be made without damage to existing bulkheads.

The project as stated above was duly approved, and it was adopted under the river and harbor act of March 3, 1899.

A sketch of Wallabout Channel was printed in House Doc. No. 50, Fifty-fifth Congress, third session.

No harbor lines have ever been established by the United States in Wallabout Channel.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Under the appropriation of $40,000, made by the river and harbor act of March 3, 1899, the project for expenditure of which was approved by the Secretary of War March 20, 1899, after duly advertising for proposals, a contract was entered into with John H. Fenner for doing the dredging required under the project at the rate of 9⅜ cents per cubic yard, measured in scows.

Dredging under this contract was commenced on June 7, and up to the close of the fiscal year 31,809 cubic yards of material had been removed, and the depth made was 20 feet at mean low water over an area which had depths before dredging of from 13 to 20 feet.

Work was commenced at the East River and carried southwardly toward the causeway a distance of about 500 feet, with the full width proposed, completing the dredging over about one-quarter of the area designed to be improved.

PRESENT CONDITION OF IMPROVEMENT.

The dredged channel has been made 20 feet deep at mean low water, with widths of from 250 to 300 feet from the entrance at East River southwardly toward the causeway, a length of about 500 feet. Over the remainder of the area included in the project the mean low-water depths range from 5 to 20 feet.

PROPOSED OPERATIONS.

It is proposed to complete the improvement with the funds now available.

Wallabout Channel is in the collection district of New York. The nearest light-house is on Blackwells Island, East River, New York. The nearest work of defense is Fort Columbus, Governors Island, New York Harbor.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899		$40,000.00
June 30, 1899, amount expended during fiscal year		297.76
July 1, 1899, balance unexpended		39,702.24
July 1, 1899, outstanding liabilities	$3,107.09	
July 1, 1899, amount covered by uncompleted contracts	14,174.16	
		17,281.25
July 1, 1899, balance available		22,420.99

Appropriation for improving Wallabout Channel, New York, $40,000, by act of March 3, 1899.

Abstract of proposals for dredging in Wallabout Channel, New York Harbor, received in response to advertisement dated April 3, 1899, and opened May 2, 1899, by Maj. H. M. Adams, Corps of Engineers.

No.	Name and address of bidder.	Dredging about 183,000 cubic yards, scow measurement.	
		Price per cubic yard.	Amount.
		Cents.	
1	R. G. Packard Co., 130 Pearl street, New York City	19	$34,770.00
2	Atlantic Dredging Co., 31 Pine street, New York City	15	27,450.00
3	Henry Du Bois Sons Co., 119 South street, New York City	12 9/10	23,607.00
4	James R. Steers, 1 Broadway, New York City	14⅜	26,306.25
5	Morris & Cumings Dredging Co., 17 State street, New York City	19 9/10	36,417.00
6	P. Sanford Ross (incorporated), 277 Washington street, Jersey City, N. J	19½	35,685.00
7	William H. Taylor, jr., 22 Emory street, Jersey City, N. J	14¼	26,077.50
8	Frank H. Brainard, 17 State street, New York City	19⅞	36,371.25
a 9	John H. Fenner, Jersey City, N. J	9⅜	17,156.25
10	Thomas H. Benton, Elizabeth, N. J	20	36,600.00

a Lowest bid.

Contract in force.

Name of contractor: John H. Fenner.
Date of contract: May 10, 1899.
Date of approval: May 29, 1899.
Date of commencement: On or before June 29, 1899.
Date of completion: On or before December 29, 1899.
Dredging 183,000 cubic yards, more or less, of material, at 9⅜ cents per cubic yard, measured in scows.
Work was begun on June 7.

COMMERCIAL STATISTICS.

Complete data regarding commerce for the year 1898 has not yet been received. The following is a statement of commerce for the year 1897, with the exception of amounts of lumber and produce received, which could not be ascertained:

	Tons.	Value.
Received	314,000	$15,086,000
Shipped	26,300	922,000
Total	340,300	16,008,000

The vessels carrying above freights were as follows:

Kind.	Number.	Draft, loaded.	Tonnage (average).
		Feet.	
Steamers	29	18 to 27	1,420
Sail vessels	75	11 to 24	100 to 1,200
Barges, lighters, etc	608	6 to 18	200 to 2,260
Total	712		

Vessels drawing over 21 feet have to be lightened before reaching the docks at high tide.

E 15.

IMPROVEMENT OF CANARSIE BAY, NEW YORK.

Canarsie Bay is the northwest part of Jamaica Bay at and in front of Canarsie Landing.

PROJECT FOR IMPROVEMENT.

The project for this improvement, adopted in 1880 and subsequently modified, consists in making a channel from deep water in Jamaica Bay to Canarsie Landing, to be 6 feet deep at mean low water and from 100 to 150 feet wide, and to protect it by two parallel dikes near its outer end; also to make a channel 4 feet deep to connect Canarsie Landing with Island Channel. The estimated cost is $88,000.

Further descriptions of the locality and the project for improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1114.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done.

PRESENT CONDITION OF IMPROVEMENT.

The two pile dikes built at the east entrance of the main channel to Canarsie Landing are in fair condition. The north dike is 1,058 feet long, 50 feet being a return at the east end. It is mainly of creosoted timber. The channel face, for a linear distance of 20 feet near the outer end, has been broken down by the ice and the stone filling released. The south dike is 820 feet long. It is not creosoted, and many of the piles are worm-eaten.

The stone filling in both dikes has settled slightly.

The dredged channel from Canarsie Landing to "Big Channel" in Jamaica Bay has been made 125 to 150 feet wide and full 6 feet deep at mean low water, and the channel northeastwardly to Gophel Channel has been dredged 5 feet deep and about 50 feet wide. The channel southwestwardly from Canarsie Landing to Island Channel, dredged 4 feet deep, has shoaled to 3 feet depth or less.

PROPOSED OPERATIONS.

Future appropriations will be applied to keeping the dikes in repair and to maintaining and widening the dredged channels. Except for widening the dredged channels in places, the project for improvement is completed.

Maintenance funds are required owing to the perishable nature of the dikes and the gradual filling in of the dredged channels.

Canarsie Bay is in the collection district of New York. The nearest light-house is on the west end of Coney Island, about 7 miles to the southwest. The nearest work of defense is Fort Hamilton, New York Harbor.

Money statement.

July 1, 1898, balance unexpended		$529.41
July 1, 1899, balance unexpended		529.41
Amount (estimated) required for completion of existing project		23,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	5,000.00	
		15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations for improving Canarsie Bay, New York, have been made as follows:

Application.	Date.	Amount.
Constructing north dike, about 1,000 feet	June 14, 1880	$10,000
Dredging east channel, repairing north dike with crib at east end	Mar. 3, 1881 Aug. 2, 1882	5,000 3,000
Dredging east channel, extending north dike 50 feet	July 5, 1884	5,000
Dredging east channel, building south dike 820 feet	Aug. 5, 1886	10,000
Dredging east and southwest channels	Aug. 11, 1888	10,000
Dredging east channel, repairs north dike	Sept. 19, 1890	5,000
Dredging east and southwest channels	July 13, 1892	5,000
Repairs of dike, dredging	Aug. 18, 1894	2,000
Dredging	June 3, 1896	10,000
Total		65,000

No contract for this work has been in force during the fiscal year ending June 30, 1899.

COMMERCIAL STATISTICS.

A statement of commerce for the year 1898 has been asked for, but not yet received.

For the year 1896 the reports showed a tonnage of 50,087 tons of freight, valued at $427,375.

No new lines of transportation are reported as established during the past fiscal year.

E 16.

IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, NEW YORK.

Browns Creek is a small stream flowing midway between the villages of Sayville and Bayport, near the south shore of Long Island, and emptying into Great South Bay about 11 miles northeast from Fire Island Inlet.

PROJECT FOR IMPROVEMENT.

In 1890 a project for improving Browns Creek was adopted, under which it was proposed to make a harbor where fishing boats can lie in rough weather, by widening and deepening the stream up to the highway bridge, making it 100 feet wide and 4 feet deep at mean low water, with 2 feet greater depth at the entrance, and to protect the entrance channel by jetties on either side, the west jetty to be 1,600 feet long and the east jetty 1,400 feet long.

By act of Congress approved March 3, 1899, an appropriation of $3,000 was made for continuing improvement and maintenance.

It is proposed to expend this amount in dredging to extend and maintain the existing channel.

Further description of the locality and project is printed in the Annual Report of the Chief of Engineers for 1897, pages 1111–1112.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No active operations were in progress.

PRESENT CONDITION OF IMPROVEMENT.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water, and both partly covered at the shore end by accretion. They are in fair condition.

The dredged channel is 2,993 feet long, with depth of 4 feet at mean low water and width of 100 feet. About 2,500 linear feet of the channel lies inside the shore line and is frequently used for night and winter anchorage by small oyster boats. Private canals, aggregating 1,525 feet in length, have been dredged into the marsh on the east side of the creek for additional anchorage and for business purposes.

PROPOSED OPERATIONS.

The available funds will be applied to extending and maintaining the channel.

Browns Creek is in the collection district of New York. The nearest light-house is at Fire Island Inlet, about 11 miles southwest. The nearest works of defense are the fortifications at Willets Point, N. Y., about 35 miles west, and Fort Hale, Conn., about the same distance northeastwardly.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$3,000.00
July 1, 1899, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	18,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Browns Creek have been made as follows:

Application.	Date.	Amount.
Jetties and dredging	Sept. 19, 1890	$12,000
Dredging	July 13, 1892	5,000
Do	Aug. 18, 1894	4,000
Do	June 3, 1896	4,000
Do	Mar. 3, 1899	3,000
Total		28,000

No contract for this work has been in force during the fiscal year ending June 30, 1899.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

Freight received and shipped.

Articles.	Tons.	Estimated value.
Received:		
Coal, brick, etc	2,500	$15,800
Oysters received by water and shipped by rail	6,000	150,000
Clams	330	6,000
Shipped:		
Oysters	1,530	35,000
Clams	330	6,000
Fish	10	1,000
Total	10,700	213,800

Vessels using creek.

Class.	Number.	Round trips.	Tonnage.	Draft.
			Tons.	*Feet.*
Sailing vessels with cargoes		720	5 to 50	2 to 5
Vessels for repairs	225	(*a*)	2½ to 15	2 to 4
Vessels using creek for shelter	200	(*a*)	2½ to 50	2 to 5

a Not known.

The amount of freight reported above is 1,520 tons more than reported for 1897. No new lines of transportation are reported as established since July 1, 1898.

E 17.

IMPROVEMENT OF PATCHOGUE RIVER, NEW YORK.

This is a small tidal stream on the south side of Long Island, emptying into Great South Bay near its eastern end, about 55 miles east in a direct line from New York City.

PROJECT FOR IMPROVEMENT.

In 1890 a project for improving this stream was adopted which contemplated dredging a channel 60 feet wide and 6 feet deep at mean low water from Great South Bay to the head of navigation, a distance of about 5,000 feet, and protecting the entrance channel from westerly storms by a jetty 1,700 feet long, at a total estimated cost of $40,000.

Further details of the river and the projected work are printed in the Annual Report of the Chief of Engineers for 1897, page 1108.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done.

PRESENT CONDITION OF IMPROVEMENT.

The jetty has been made 1,700 long.

The channel has been dredged 60 feet wide and 6 feet deep at mean low water from Great South Bay to 80 feet from the harbor lines at the head of the harbor. At the upper part for 300 feet length it was made 100 feet wide to allow vessels to turn about, and parts of the channel have been widened by private parties.

PROPOSED OPERATIONS.

The work contemplated under the adopted project has been completed, but dredging will be required from time to time to maintain the improvement.

The river and harbor act of March 3, 1899, provides for a preliminary examination, with a view to extended improvements.

Patchogue River is in the collection district of New York. The nearest light-house is at Fire Island Inlet, 14 miles southwest. The nearest work of defense is Fort Hale, New Haven Harbor, Connecticut, about 35 miles in a direct line northward.

Money statement.

July 1, 1898, balance unexpended	$710.60
June 30, 1899, amount expended during fiscal year	3.75
July 1, 1899, balance unexpended	706.85
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Appropriations for improving Patchogue River, New York, have been made as follows:

Application.	Date.	Amount.
Constructing jetty and dredging	Sept. 19, 1890	$15,000
Dredging	July 13, 1892	8,000
Dredging and jetty	Aug. 18, 1894	4,000
Do	June 3, 1896	13,000
Total		40,000

No contract for this improvement has been in force during the past fiscal year.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1898.

Arrivals and departures of vessels.

[Draft, 2 to 9 feet; tonnage, 8 to 350 tons.]

Class.	Number of round trips.	Aggregate tonnage of all trips.
		Tons.
Steamers	1,325	77,000
Sailing vessels	7,500	90,000
Barges	4,500	168,750
Total	13,325	335,750

Vessels of 9 feet draft can not come into the river without lightering.

Freight received and shipped by water.

Class.	Tons.	Estimated value.
Received:		
Coal	13,000	$65,000
Lumber	150,000	1,875,000
Miscellaneous	26,000	156,000
Shipped:		
Lumber	53,000	1,328,000
Fish and shellfish	5,200	158,000
Miscellaneous	8,000	120,000
Total	255,200	3,702,000

Vessels built and repaired, 1898.

	Number.	Tons.
Vessels built during 1898	50	2 to 60
Vessels repaired during 1898	425	2 to 350

The above figures show an increase in freight over the amount reported for 1897 of 5,200 tons.

No new lines of transportation are reported as established since July 1, 1898.

E 18.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK OF SCHOONER "RICHARD HALL" IN LONG ISLAND SOUND, OFF PORT CHESTER HARBOR, NEW YORK.

This vessel, a two-masted schooner, was sunk October 1, 1898, off Portchester Harbor, in 40 feet of water, about 1¼ miles S. ½ W. from Blue Fish Shoal, Long Island Sound, both masts being visible.

The wreck formed a serious obstruction to navigation, and an allotment of $500 was made for the purpose of removing the dangerous parts of the derelict.

Proposals were invited for the removal of the wreck to a clear depth of 25 feet below mean low water. Nine bids were received, and the lowest, for $150, presented by the Merritt and Chapman Derrick and Wrecking Company, was accepted.

The wreck was partly removed during the month of December, 1898. Subsequent examinations showed that a full depth of 25 feet below mean low water had not yet been obtained and that parts of the wreck were still 4 feet above that plane.

The contractors were requested to remove the obstruction to the required depth, but the work has not yet been completed; arrangements for its completion are in progress.

E 19.

SURVEY OF WALLABOUT CHANNEL, NEW YORK, WITH A VIEW TO SECURING A DEPTH OF 20 FEET AND WIDTH OF 300 FEET, MEAN LOW WATER, FROM ITS ENTRANCE TO THE TIMBER CAUSEWAY.

[Printed in House Doc. No. 50, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., November 29, 1898.

SIR: By the provisions of joint resolution approved June 16, 1898, the Secretary of War is authorized and directed to submit estimates for work on Wallabout Channel, New York, with a view to securing a depth of 20 feet and a width of 300 feet at mean low water from its entrance to the timber causeway, in accordance with the plans heretofore submitted, and his opinion as to the advisability of the proposed improvement is requested.

The duty of making the survey necessary for preparation of plan and estimate called for by this resolution was assigned to Maj. H. M. Adams, Corps of Engineers, and I have now the honor to submit the accompanying copy of that officer's report, dated August 24, 1898, with map,[1] furnishing the information called for.

Major Adams states that it is not advisable to make the channel 300 feet wide between the north end of Cob Dock and the Brooklyn shore, where, however, for a distance of about 400 feet a width ranging from 230 to 300 feet can readily be obtained. He therefore submits an estimate amounting to $40,000 as the cost of dredging a channel 20 feet deep at mean low water from the entrance to the vicinity of the new masonry causeway, with widths ranging from 230 feet to 300 feet, and states that, in his opinion, Wallabout Channel is worthy of improvement by the United States to this extent.

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[1] Not reprinted. Printed in House Doc. No. 50, Fifty-fifth Congress, third session.

His views are concurred in by General Gillespie, Division Engineer, and by me.

Very respectfully, your obedient servant,

A. MACKENZIE,
Acting Chief of Engineers.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJOR H. M. ADAMS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York City, August 24, 1898.

GENERAL: In compliance with instructions contained in letter from the Chief of Engineers dated July 25, 1898, I have the honor to submit the following report, with estimates of cost of deepening Wallabout Channel, New York, to a depth of 20 feet at mean low water, together with a map showing present depths in that channel.

Under the terms of the river and harbor act of 1896, a preliminary examination of Wallabout Channel was made, the report upon which was printed in House Doc. No. 122, Fifty-fourth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1897, page 1047. This report stated that Wallabout Channel is worthy of improvement by the General Government to the extent of increasing the depth of the eastern channel to 20 feet at mean low water from the entrance to the timber causeway, and that the cost of such a survey as would be necessary for preparation of a report and estimates would be $250.

By a joint resolution of Congress approved June 16, 1898, it was resolved—

> That the Secretary of War be, and he is hereby, authorized and directed to submit estimates for work on Wallabout Channel, New York, with a view to secure a depth of twenty feet and a width of three hundred feet at mean low water from its entrance to the timber causeway, in accordance with the plans heretofore submitted, and that the Secretary of War be, and is hereby, requested to submit his opinion as to the advisability of the proposed improvement.

The sum of $250 was allotted by letter of the Chief of Engineers dated July 25, 1898, from appropriation for examinations, surveys, and contingencies of rivers and harbors, to pay the expenses attendant upon preparing the information called for by Congress.

A survey of the eastern entrance of Wallabout Channel was made in July and August, 1898.

This survey shows that the timber causeway has recently been replaced by a masonry causeway, connecting the island known as Cob Dock with the navy-yard on a line about 400 feet northeast of the old timber causeway, and also that the minimum width of this channel between the masonry sea wall at the north end of the island and the Brooklyn water front at Division street is 272 feet. To secure a full width of 300 feet would require tearing down this wall for a length of about 300 feet and excavating land above high-water mark now used as part of the navy-yard. This evidently was not contemplated in the report upon preliminary examination, and in my opinion the advantage gained would not compensate for cost and damage to Government property. The channel could be deepened without damage to existing piers, bulkheads, or sea walls, making a width of 300 feet or over, except for about 400 feet length opposite the north end of the island (Cob Dock), where the widths would range between 230 and 300 feet. This would be ample for the needs of existing navigation and for such prospective increase in it as can be foreseen.

In connection with the soundings the bottom was frequently probed with an iron rod, and no material harder than sand was found.

The cost of this work is estimated as follows:

Dredging 183,000 cubic yards of sand, mud, etc. (scow measurement), at 20 cents per yard	$36,600
Supervision, etc., about 10 per cent	3,400
Total	40,000

To excavate land above high water, removing and replacing the masonry sea wall in such way as to make the channel opposite the north end of the island 300 feet wide, would add about $25,000 to the above cost, independent of damage to property, and would result in no corresponding benefit to navigation.

In my opinion, Wallabout Channel is worthy of improvement by the United States, for the reasons stated in the report upon the preliminary examination, to the extent of making it 20 feet deep at mean low water from the entrance to the vicinity of the new masonry causeway, with widths ranging from 230 to 350 feet—as great as can be made without damage to existing bulkheads.

The commerce in Wallabout Channel consists chiefly of coal, sugar and sirups, ice, lumber, and produce.

The amounts of lumber and produce received during 1897 could not be ascertained. The other commerce is reported as follows:

	Tons.	Value.
Received	314,000	$15,086,000
Shipped	26,300	922.000
Total	340,300	16,008,000

The vessels carrying above freights were as follows:

Kind.	Number.	Draft, loaded.	Tonnage.
		Feet.	*Tons.*
Steamers	29	18 to 27	[a]1,420
Sail vessels	75	11 to 24	200 to 1,200
Barges, lighters, etc	608	6 to 18	200 to 2,260
Total	712	....	....

[a] Average.

Vessels drawing over 21 feet have to be lightened before reaching the docks at high tide.

Very respectfully, your obedient servant,

H. M. ADAMS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, August 25, 1898.

Respectfully forwarded to the Chief of Engineers, concurring in the views of the district officer.

G. L. GILLESPIE,
Colonel, Corps of Engineers,
Brig. Gen., U. S. Volunteers, Division Engineer.

E 20.

MODIFICATION OF HARBOR LINES IN EAST RIVER ON THE WESTERLY SIDE OF RIKERS ISLAND, NEW YORK.

THE CITY OF NEW YORK,
DEPARTMENT OF DOCKS AND FERRIES,
New York, April 28, 1899.

SIR: At a meeting of the board of docks, held this date, the following resolution was adopted:

> Resolved, That this board recommends to the Secretary of War that the bulkhead and pierhead line on the westerly side of Rikers Island, as established by the Secretary of War January 9, 1891, be and hereby is modified so as to extend from the angle in the bulkhead and pierhead line at the southwesterly corner of Rikers Island north seventeen degrees forty-five minutes west along the bulkhead and pierhead line, as heretofore established, to within fifty feet of the next course; thence to run exterior to on lines parallel with and fifty feet from the bulkhead and pierhead line heretofore established to the northerly end of the course which bears north eight degrees thirty minutes east; thence in a straight line to the angle in the bulkhead and pierhead line at the northerly end of Rikers Island, as heretofore established.
>
> The necessity for the extension of this line arises from the fact that the crib work placed on the western boundary of Rikers Island has already changed its original position to such an extent as to be in great part outside the Government pierhead and bulkhead lines at this locality. In order to prevent this crib from further encroaching upon the channel, it will be necessary to place a bank of heavy riprap stone outside the present crib, and this can only be done if the United States Government grants permission to extend the line at this locality. The reason of this application occurs from the above facts, and should this request be granted, the department would then be enabled to hold the crib work from further encroachment upon the channel. The fifty feet of extension requested will not materially decrease the width of the channel at the locality in question.

I have forwarded by mail, under separate cover, map[1] showing the position of the new line around the westerly shore of Rikers Island, as requested above.

Yours, respectfully,

WM. H. BURKE,
Secretary.

Hon. RUSSELL A. ALGER,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 3, 1899.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

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[1] Not printed.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, May 8, 1899.

Respectfully returned to the Chief of Engineers recommended for approval, provided that a substantial bulkhead shall be built along the line proposed and that no further deposits be made in rear of this line until the bulkhead is completed to such a height as to prevent the exit of the débris with the ebb of the tide.

For the Board:

HENRY M. ROBERT,
Colonel, Corps of Engineers, President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 10, 1899.

Respectfully returned to the Secretary of War.

The department of docks and ferries of New York City requests an extension of the established pierhead and bulkhead line on the westerly side of Rikers Island, East River, a distance of 50 feet, as shown in green on the accompanying map.[1] The extension is desired for the purpose of enabling the city authorities to place a bank of heavy riprap stone on the line to prevent the existing crib work on that side of the island from further encroaching upon the channel.

The matter has been considered by the New York Harbor Line Board, in whose recommendation, in third indorsement hereon, I concur.

A. MACKENZIE,
Acting Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT, *May 15, 1899.*

Approved as recommended by the New York Harbor Line Board and concurred in by the Acting Chief of Engineers in the third and fourth indorsements hereon.

R. A. ALGER,
Secretary of War.

E 21.

MODIFICATION OF HARBOR LINES IN EAST RIVER BETWEEN BUNGAY AND CABOT STREETS, OAK POINT, NEW YORK CITY.

THE NEW YORK, NEW HAVEN AND
HARTFORD RAILROAD COMPANY,
VICE-PRESIDENT'S OFFICE,
New Haven, Conn., February 17, 1899.

DEAR SIR: The undersigned, the New York, New Haven and Hartfold Railroad Company, represents—

That it is the owner of the upland on the East River, in the Twenty-third Ward, in the city, county, and State of New York, extending from

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[1] Not printed.

Bungay street northerly to a line 100 feet south of Cabot street, as shown on the map,[1] triplicates of which are herewith inclosed;

That the United States pier and bulkhead line is also shown on said map;

That the undersigned railroad company desires to make improvements along the line of said water front by building ferry slips, as shown on said map, which improvement it will be impracticable to make with the pierhead line remaining as at present;

That it is desirable that the pierhead line heretofore established by the United States authorities, and now identical with the bulkhead line, should be changed so as to correspond substantially with the proposed new pierhead line, as shown in red on the inclosed map; and

That the proposed new pierhead line would generally improve the alignment of any piers that may hereafter be built along said water front.

The undersigned railroad company, therefore, hereby makes application to your department for a change of the pierhead line from its present location, as shown on said map, to the proposed new location, as also shown on said map, the bulkhead line to remain as heretofore established by the United States authorities.

If any further documents or more detailed information are required in the matter above set forth we shall be glad to furnish the same.

THE NEW YORK, NEW HAVEN AND
HARTFORD RAILROAD COMPANY,
By JOHN M. HALL, *Vice-President.*

To the Hon. RUSSELL A. ALGER,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 21, 1899.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, for consideration and report by the New York Harbor Line Board.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieutenant-Colonel, Corps of Engineers.

[Third indorsement.]

THE NEW YORK HARBOR LINE BOARD,
New York City, April 13, 1899.

Respectfully returned to the Chief of Engineers with inclosed report of this date.

* * * * * * *

HENRY M. ROBERT,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 17, 1899.

Respectfully returned to the Secretary of War.

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[1] Not printed.

The New York, New Haven and Hartford Railroad having requested a modification of the existing pierhead line on East River between Bungay and Cabot streets, New York City, the subject has been under consideration by the New York Harbor Line Board, to whose report of the 13th instant, herewith, attention is respectfully invited.

After consultation with the parties interested, the Board recommends the following modification in the pierhead line for the north shore of East River, between Bungay and Cabot streets, Oak Point, New York City:

Beginning at a point in the established pier and bulkhead line approved by the Secretary of War January 9, 1891, in the southerly prolongation of a line 40 feet west from the westerly side of One hundred and forty-ninth street and parallel thereto, 418 feet south from the northerly side of Edgewater road; thence easterly in a straight line to a point in the southerly prolongation of a line 50 feet west from the westerly side of Poillon street and parallel thereto, 455 feet south from the northerly side of Edgewater road; thence easterly in a straight line to a point in the southerly prolongation of a line 115 feet east from the easterly side of Arnold street and parallel thereto, 430 feet south from the northerly side of Edgewater road; said last-mentioned point being in the modified pierhead line approved by the Secretary of War June 11, 1892.

The proposed modification is shown in red on the accompanying tracing,[1] which has been prepared for the signature of the Secretary of War.

Approval is recommended.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT, *April 19, 1899.*

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War.

JOHN C. SCOFIELD, *Chief Clerk.*

REPORT OF BOARD OF ENGINEERS.

THE BOARD OF ENGINEERS,
New York City, April 13, 1899.

GENERAL: In compliance with your indorsement of February 21, 1899, the New York Harbor Line Board has considered the application of the New York, New Haven and Hartford Railroad Company dated February 17, 1899, for modification of the pierhead line between Bungay and Cabot streets, East River, New York City, and has the honor to submit the following report thereon:

An application had been made for a change in the pierhead line just above the property of the New York, New Haven and Hartford Railroad Company, and as there were no other properties affected by these modifications, a hearing in the matter was given on March 6, 1899, at which Mr. S. L. F. Deyo, the district engineer of the New York, New Haven and Hartford Railroad Company, and Gen. Egbert L. Viele, were present, these two parties being the only ones affected and therefore the only ones invited to the hearing.

The pierhead line as applied for contracts the river at a narrow point, which seemed very objectionable to the Board. As a result of the discussion the railroad company has put in a modified application which does away with the above objection, but throws the eastern end of the proposed modified line out into very deep water. After consultation with the parties interested, the Board recommends a modified pierhead line which is very nearly like the one asked for in their revised application, the eastern part of the line, however, being thrown back so as to extend outside of the proposed ferry piers.

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[1] Not printed.

The Board therefore recommends the following modification in the pierhead line for the north shore of East River between Bungay and Cabot streets, Oak Point, New York City:

Beginning at a point in the established pier and bulkhead line approved by the Secretary of War January 9, 1891, in the southerly prolongation of a line 40 feet west from the westerly side of One hundred and forty-ninth street and parallel thereto, 418 feet south from the northerly line of Edgewater road; thence easterly in a straight line to a point in the southerly prolongation of a line 50 feet west from the westerly side of Poillon street and parallel thereto, 455 feet south from the northerly side of Edgewater road; thence easterly in a straight line to a point in the southerly prolongation of a line 115 feet east from the easterly side of Arnold street and parallel thereto, 430 feet south from the northerly side of Edgewater road; said last-mentioned point being in the modified pierhead line approved by the Secretary of War June 11, 1892.

A tracing[1] is inclosed showing the proposed modified lines in red. (Forwarded in separate roll.)

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.
H. M. ADAMS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

E 22.

MODIFICATION OF HARBOR LINES IN EAST RIVER BETWEEN EAST TWENTY-THIRD AND EAST TWENTY-FOURTH STREETS, NEW YORK CITY.

THE CITY OF NEW YORK,
DEPARTMENT OF DOCKS AND FERRIES,
New York, March 10, 1899.

SIR: At a meeting of the board of docks, held this day, the following preamble and resolution were adopted:

Whereas the present bulkhead line between East Twenty-third and East Twenty-fourth streets, East River, as shown on the map approved by the Secretary of War April 25, 1890, extends from a point in the northerly side of East Twenty-third street, distant 603.39 feet easterly from the westerly side of Avenue A, and runs thence westerly along said northerly side of East Twenty-third street to a point 322 feet easterly from the westerly side of Avenue A, and runs thence northerly in a line parallel with said westerly side of Avenue A, and distant 322 feet easterly therefrom to the southerly side of East Twenty-fourth street, at a point distant 322 feet easterly from the said westerly side of Avenue A;

Resolved, That this board recommends to the Secretary of War that the bulkhead line as above described be, and hereby is, modified so as to extend from the aforesaid point in the northerly side of East Twenty-third street, distant 603.39 feet easterly from the westerly side of Avenue A, and run thence westerly along said northerly side of East Twenty-third street 130 feet to a point distant 473.39 feet easterly from the said westerly side of Avenue A, and thence northwesterly to the aforesaid point in the southerly side of East Twenty-fourth street, distant 322 feet easterly from the westerly side of Avenue A.

Yours, respectfully,

WM. H. BURKE, *Secretary.*

Hon. RUSSELL A. ALGER,
Secretary of War.

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[1] Not printed.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 16, 1899.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, for consideration and report, by the New York Harbor Line Board.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, April 12, 1899.

Respectfully returned to the Chief of Engineers with recommendation that the within application of the department of docks and ferries of the city of New York for modification of the harbor lines on East River, New York City, from East Twenty-third to East Twenty-fourth streets, as indicated in red on the inclosed map, be approved.

For the Board:

HENRY M. ROBERT,
Colonel, Corps of Engineers, President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 15, 1899.

Respectfully returned to the Secretary of War.

The department of docks and ferries of the city of New York requests a modification of the established bulkhead line on East River, between East Twenty-third and East Twenty-fourth streets, shown in red on the accompanying map.[1]

Attention is invited to the recommendation of the New York Harbor Line Board in third indorsement hereon, in which I concur.

The map has been prepared for signature of the Secretary of War.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT, *April 17, 1899.*

Approved in accordance with the recommendation of the New York Harbor Line Board, as concurred in by the Chief of Engineers.

R. A. ALGER,
Secretary of War.

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[1] Not printed.

APPENDIX F.

IMPROVEMENT OF NEW YORK HARBOR, BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, AND GOWANUS CREEK CHANNEL, NEW YORK.

REPORT OF MAJOR H. M. ADAMS, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. New York Harbor, New York.
2. Bay Ridge Channel, the triangular area between Bay Ridge and Red Hook channels, and Red Hook and Buttermilk channels, New York Harbor.
3. Gowanus Creek Channel, New York.
4. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEY.

5. East Channel, New York Harbor, from the Narrows to the sea.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., July 17, 1899.

GENERAL: I have the honor to transmit herewith annual report upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

H. M. ADAMS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

F 1.

IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

New York Harbor is the general designation of the water front of and approaches to the city of New York, comprising the Upper and Lower bays and parts of the Hudson, East, and Harlem rivers.

New York Harbor has two entrances, one from Long Island Sound by East River and Hell Gate, used by vessels trading eastward between New York, the Eastern States, and British American provinces; the other, the main entrance from the sea, by Sandy Hook through the Narrows, used by trans-Atlantic and Southern traffic. The title "Improvement of New York Harbor" has been applied to improvement of the channel of the main entrance from the sea.

From the Battery, at the lower end of New York City, out through the Narrows to the Lower Bay, a total distance of about 9 miles, there is a natural channel fairly broad and unobstructed, with available depths of 45 feet or more at mean low tide. The Lower Bay is separated from deep water of the ocean by a bar from 2 to 5 miles across, which, except for the channels crossing it, extends all the way from Sandy Hook to the west end of Coney Island, a distance of 7 miles. On the west side of this bar the Main Ship Channel extends southward from the Narrows to Sandy Hook, with natural depth of 23.3 feet, since opened.

Five distinct natural channels, separated by sand shoals, cross this bar, in order as follows, from the north or Coney Island shore.

(1) The Coney Island Channel, straight, narrow, with a general depth of 20 feet except at the west end, where the available depth is but 10 feet. South of this channel lies a shoal known as East Bank, with least depth of 6 feet.

(2) The Fourteen-foot Channel, a curving channel with considerable depths in the west part, but with only 15 feet depth at the eastern end. To the south lies a shoal with 5½ feet least depth.

(3) The East Channel, a broad, nearly straight channel of 30 feet depth or more in the western part, separated from deep water on the east by a bar having only 19 feet depth. South of this channel lies Romer Shoal, with 3 feet least depth.

(4) The Swash Channel, with 22 feet depth in a narrow channel. To the south lies a shoal called Flynns Knoll, with least depth of 11 feet.

(5) The Main Channel, a broad channel passing close to the north shore of Sandy Hook, with natural available depth of 28 feet.

The southern part of the Main Ship Channel, with the Swash and Main channels, form nearly an equilateral triangle, the two last named intersecting in a deep hole of considerable area rather more than midway across the bar. Outside this deep hole the bar was about 20 feet deep and was crossed by two channels, the north, called Gedney Channel, about 1½ miles long to deep water, and the south, called South Channel, somewhat longer, extending southeast nearly in continuation of the Swash Channel. Gedney and South channels both had natural depths of 24 feet.

Thus the natural channels afforded an available low-water depth from the ocean to the lower wharves of New York City of 23.3 feet, the distance from the outer side of the outer bar being 21 miles.

PROJECT FOR IMPROVEMENT.

This project, adopted in 1884 and subsequently extended, consisted in making a channel 1,000 feet wide and 30 feet deep at mean low water from New York Harbor to deep water in the Atlantic by way of Sandy Hook, at an estimated cost of $1,490,000. Work was begun September 26, 1885, and the project was completed October 10, 1891. Appropriations since that time have been applied to maintaining the channel by increasing its width and by removing shoals.

Under special projects between 1863 and 1894 small allotments from various appropriations have been from time to time expended in protecting the north shore of Sandy Hook by building jetties from high-water mark out to below low water and by building riprap sea walls alongshore just below high-water line.

Under the terms of the river and harbor act of March 3, 1899, a new project was adopted for connecting deep water in the lower bay with the ocean by channel 2,000 feet wide and 40 feet deep at mean low water, crossing the bar by way of East Channel, at a limit of cost of $1,000,000.

Further detailed descriptions of the harbor and improvements are printed in the Annual Reports of the Chief of Engineers for 1885, page 773, and for 1897, page 1031.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

At the beginning of the fiscal year the United States dredging steamer *Gedney* was at work deepening shoal places in the channel on the south side of Northwest Shoal. This work was continued until November 12, when the channel of 30 feet depth at mean low water had been widened at this part of the bend to a width of 2,000 feet, being 1,000 feet either side of the channel range. During the winter repairs to the hull and machinery of the dredge were made. Work was resumed April 6, and to the close of the year a small shoal in Main Ship Channel, between Swash Channel junction buoy and Buoy C 2, was removed, and a shoal on the south side of Bayside Channel was deepened; June 26 work was begun upon widening and deepening the west side of Main Ship Channel near the south end of Chapel Hill Range.

The amount of material dredged during the past fiscal year was 199,837 cubic yards, of which 13,632 cubic yards were from Main Ship Channel, 108,894 cubic yards from Northwest Shoal, and 77,311 cubic yards from the east end of Bayside Channel. The average cost per cubic yard of operating expenses, including repairs and supplies, is estimated at 10.6 cents during the year.

The river and harbor act of March 3, 1899, contained a provision for improving New York Harbor—

> By a deep channel two thousand feet wide and forty feet deep from the Narrows, by the so-called East Channel, across Sandy Hook Bar to the open sea, in accordance with the recommendations contained in House Document Numbered One hundred and fifty-nine, Fifty-fifth Congress, third session, one million dollars: *Provided*, That the Secretary of War may forthwith enter into a contract or contracts for such materials and work as may be necessary for the completion of said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate three million dollars, exclusive of the amount herein and heretofore appropriated.
>
> If, however, the Secretary of War shall be unable to make a contract or contracts for the completion of said project for a sum within the amounts above specified, then the said one million dollars herein appropriated, or so much thereof as may be necessary, shall be applied by him in the construction or purchase of such dredges, steamboats, and other plant, machinery, and appliances as may be necessary to prosecute said project, and shall cause the work on said project to be entered upon and prosecuted under the charge of the Secretary of War by employment of labor and materials necessary therefor, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate the said sum of three million dollars, exclusive of the one million dollars herein appropriated.

Under this project, so adopted, proposals were invited for the excavation estimated as necessary to complete the channel, and a contract was entered into with Andrew Onderdonk, of New York City, to excavate and remove 42,500,000 cubic yards of material, at 9 cents per cubic yard measured in scows; contract dated May 12, 1899, approved by the Chief of Engineers May 24, 1899; expiration indefinite, depending upon appropriations. The specifications require that excavation shall begin within twelve months from the date of approval of contract, and that during eight working months of the year the average monthly rate of excavation shall be 400,000 cubic yards during the first working year and 1,200,000 cubic yards during each succeeding year. Dredging under the contract has not yet been begun.

PRESENT CONDITION OF IMPROVEMENT.

The improved channel from deep water below the Narrows to the sea by way of Sandy Hook has a depth of 30 feet and general width of 1,000 feet or more throughout its length. At the bend at Northwest Shoal the channel has been made 2,000 feet wide.

East Channel has not yet been deepened, and the available depth across the bar in range of the projected improvement is 16 feet.

PROPOSED OPERATIONS.

Under the completed project of 1884 future appropriations will be applied to maintaining the channel depths and to increasing the width at the bend near Sandy Hook and at other places where shoaling is most liable to occur.

Under the project of 1899 it is expected that dredging in East Channel will be begun.

This work is in the collection district of New York. Nearest light-houses, Sandy Hook and Highland lights. The nearest forts are the fort at Sandy Hook and those at the Narrows.

The following is the estimate of amount required for dredging East Channel under continuing contract, authorized by the river and harbor act of March 3, 1899, for the fiscal year ending June 30, 1901:

Under the terms of the contract, work must begin within twelve months from date of approval of the contract, must be prosecuted continuously during the eight favorable months of each year at a rate for the first year of at least 400,000 cubic yards per month, and for each succeeding year at a rate of at least 1,200,000 cubic yards per month. By these provisions work must begin on or before May 24, 1900 (one year from date of approval); by May 24, 1901, at least 3,200,000 cubic yards must be dredged, and by June 30, 1901, at least 5,940,000 cubic yards, which at 9 cents per yard will cost $534,600. This is the minimum amount. The contractor will undoubtedly try to exceed this amount by starting earlier than required and by working as much as possible during the winter months. It is not reasonably possible for him to double the amount, and therefore the appropriation of $1,000,000, made by act of March 3, 1899, is estimated as sufficient to meet all probable obligations under the contract up to June 30, 1901.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1898, balance unexpended	$29,228.38
Amount appropriated by river and harbor act approved March 3, 1899	100,000.00
	129,228.38
June 30, 1899, amount expended during fiscal year	27,644.15
July 1, 1899, balance unexpended	101,584.23
July 1, 1899, outstanding liabilities	2,218.67
July 1, 1899, balance available	99,365.56
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	100,000.00

EAST CHANNEL.

Amount appropriated by river and harbor act approved March 3, 1899	$1,000,000.00
June 30, 1899, amount expended during fiscal year	61.26
July 1, 1899, balance unexpended	999,938.74
July 1, 1899, amount covered by uncompleted contracts	950,000.00
July 1, 1899, balance available	49,938.74
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	3,000,000.00

Appropriations for improving New York Harbor have been made as follows:

Application.	Date.	Amount.
For Gedney Channel, dredging via Sandy Hook	July 5, 1884	$200,000.00
For New York Harbor	Aug. 5, 1886	750,000.00
Do	Aug. 11, 1888	380,000.00
Do	Sept. 19, 1890	160,000.00
Do	July 13, 1892	170,000.00
Do	Aug. 18, 1894	75,000.00
Do	June 3, 1896	60,000.00
Do	Mar. 3, 1899	100,000.00
		1,895,000.00
Received from other sources		28,024.52
Total		1,923,024.52
For East Channel, dredging	Mar. 3, 1899	1,000,000.00

Abstract of proposals for dredging East Channel, New York Harbor, received and opened April 24, 1899.

No.	Name and address of bidder.	Dredging 42,500,000 cubic yards, scow measurement.	
		Price per cubic yard.	Amount.
1	Andrew Onderdonk, 1 Broadway, New York City	$0.09	$3,825,000

Contract in force during the fiscal year ending June 30, 1899.

With Andrew Onderdonk, of New York City, N. Y., for excavating in East Channel, New York Harbor, and removing about 42,500,000 cubic yards of material, at rate of 9 cents per cubic yard; date of contract, May 12, 1899; approved by the Chief of Engineers May 24, 1899; date for beginning work, twelve months from date of approval of contract; date of expiration, indefinite, depending on appropriations by Congress. Work not yet begun.

COMMERCIAL STATISTICS.

The following statement concerning foreign commerce of the port of New York is taken from the annual report of the Chamber of Commerce of the State of New York for the year 1898–99. It comprises only foreign imports and exports, and does not include the domestic, coastwise, and local traffic. Vessels trading with domestic ports are not required to take out clearance papers, and no attempt is made to collect statistics of their carrying trade.

The leading articles of imports into the United States at the port of New York for the year ending June 30, 1898, were sugar, molasses, coffee and tea, wool, cloths, and dress goods, leather and leather goods, tin, rubber, tobacco, and other miscellaneous articles, aggregating about two and three-quarter million tons, valued at $496,397,952.

The leading articles of export were cotton, breadstuffs and other provisions, oils, tobacco, metals, manufactures, and other miscellaneous items, aggregating about six and one-half million tons, valued at $486,238,059.

For the calendar year 1898 the total valuation of imports and exports was $1,058,520,139.

Statement of the number and tonnage of all vessels belonging to the port of New York June 30, 1898.

	Number.	Tonnage.
Steam vessels	1,599	325,611
Sailing vessels	1,125	486,249
Canal boats	225	28,647
Barges	783	176,716
Total	3,732	1,017,223

F 2.

IMPROVEMENT OF BAY RIDGE CHANNEL, THE TRIANGULAR AREA BETWEEN BAY RIDGE AND RED HOOK CHANNELS, AND RED HOOK AND BUTTERMILK CHANNELS, IN THE HARBOR OF NEW YORK.

The main channel from The Narrows to the East River, New York Harbor, passes to the west and northwest of Governors Island. It has natural depths of 35 feet or over and generally an ample width. There is an eastern channel which skirts the Brooklyn water front, extending northwardly from Bay Ridge, crossing Gowanus Bay, rounding Red Hook, and thence by way of Buttermilk Channel connecting with the East River. The lower part of this channel from Bay Ridge to Erie Basin had natural depths of from 7 to 12 feet. Opposite Gowanus Bay it was separated from the main channel of the harbor by a large shoal of about 9 feet depth; the upper part had a depth of 26 feet in a channel 300 feet wide or more, but crooked, and on account of the rapid current and the large amount of traffic in and near its junction with the East River it was formerly regarded as one of the most difficult places to navigate in New York waters. The line of docks along the water front of this east channel, and especially in the upper part, from the Brooklyn Bridge to Red Hook, is one of the most important in New York Harbor.

PROJECTS FOR IMPROVEMENT.

Prior to 1896 this improvement was carried on under two separate titles: Improvement of Buttermilk Channel, New York Harbor, which included the removal of Buttermilk and Red Hook shoals, and improvement of Gowanus Bay, New York Harbor, which included Bay Ridge and Red Hook channels and the triangular area between them, and also Gowanus Creek Channel.

In 1872 a survey of Buttermilk Channel was made, and under the river and harbor act of 1880 a project was adopted for removing the eastern part of the north shoal, called Buttermilk Shoal, to a depth of 26 feet at mean low water. The project was subsequently extended to include the removal of the entire shoal, which was accomplished July 3, 1891, at a total cost of $321,000. The amount dredged from this shoal was 1,269,484 cubic yards. In 1890 a preliminary examination of Buttermilk Channel was made, and under the river and harbor act of 1892 a project was adopted for removing the south shoal, Red Hook Shoal, to a depth of 26 feet below mean low water, estimated to require the removal of 1,484,048 cubic yards of sand and small bowlders overlying clay, at a total cost of $529,000, of which $25,000 from previous appropriations remained available. This plan did not comtemplate dredging nearer to the dock line than 50 feet, thus widening the natural channel by about 1,000 feet.

Up to July 1, 1896, under this project 519,954 cubic yards had been dredged from Red Hook Shoal, cutting off the outer end of the shoal and widening the 26-foot channel by 600 feet.

A survey of Gowanus Bay was made in 1880, and under the river and harbor act of 1880 a project for improvement was adopted which, as modified by the river and harbor acts of 1890 and 1894, consisted in dredging Red Hook Channel (from Erie Basin entrance to the foot of Henry street) to a width of 400 feet and depth of 26 feet at mean low water; Gowanus Creek Channel (from Henry street to Percival street) to a width of 250 feet and depth of 21 feet; Gowanus Canal (from Percival street to the Hamilton Avenue Bridge) to a width of 200 feet and depth of 18 feet; Bay Ridge Channel (from Henry street and Twenty-eighth street to the 26-foot curve opposite Bay Ridge) to a width of 800 feet and depth of 26 feet, and the triangular area between Bay Ridge and Red Hook channels to a maximum width of 900 feet and depth of 26 feet. The total estimated cost of this work was $1,124,400. Under this project, up to July 1, 1896, Red Hook Channel had been made 200 feet wide and 26 feet deep, an additional 150 feet of width being made 21 feet deep; Gowanus Creek had been made 21 feet deep between the harbor lines; Gowanus Canal had been made 12 feet deep; Bay Ridge Channel had been made 175 to 200 feet wide and 26 feet deep, and an additional width of 175 to 200 feet had been made 21 feet deep. No work had been done upon the triangular area.

By the terms of the river and harbor act of 1896 the Bay Ridge and Red Hook channels, the triangular area between them, and the Buttermilk Channel were consolidated into one improvement, together with a small improvement of Gowanus Canal, and the project for this work now consists in dredging channels of 26 feet depth at mean low water, with widths as follows: For Bay Ridge Channel, 800 feet; for the triangular area between Bay Ridge and Red Hook channels, maximum width 900 feet; for the Red Hook Channel, 400 feet; for Buttermilk Channel, at Red Hook Shoal, 1,000 feet, and for dredging Gowanus Canal from Percival street to Hamilton Avenue Bridge to the extent of $5,000, at a total estimated cost of $837,000.

Under this consolidated project, up to July 1, 1898, 2,372,079 cubic yards of material had been dredged; Bay Ridge Channel had been widened to the projected width of 800 feet; the triangular area had been dredged 26 feet deep, and work was in progress upon the widening of Red Hook Channel; the projected work in Gowanus Canal had been completed.

Under the terms of the river and harbor act of March 3, 1899, a project was adopted for making Bay Ridge and Red Hook channels 1,200 feet wide and 40 feet deep at mean low water, at a limit of cost of $2,500,000.

Harbor lines in Gowanus Bay and Buttermilk Channel were established by the Secretary of War March 4, 1890. These harbor lines in the Gowanus Creek Channel were slightly modified by act of Congress passed June 3, 1896.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

At the beginning of the year dredging was in progress under a continuing contract entered into with the W. H. Beard Dredging Company, of New York City, under date of October 6, 1896, approved by the Chief of Engineers October 15, 1896. Work was continued without interruption during the year until June 24, 1899, when the contract was completed.

During the past fiscal year Red Hook Channel has been widened to 400 feet for its entire length. Red Hook Shoal, in Buttermilk Channel, has been made 26 feet deep from deep water to 50 feet from the existing bulkhead. Extensive shoals have been removed from the whole length of Bay Ridge Channel, overlapping into the upper end of Red Hook Channel and requiring the dredging of 825,253 cubic yards of material, mainly mud. This material ran into the channel from both sides below Forty-third street and freely from the east side above Forty-third street. The latter part of the channel was dredged about 1894, and had shoaled in places as much as 8 feet, accompanied by a corresponding and notable deepening over the flats east of the channel.

Before the completion of the dredging on Red Hook Shoal, in Buttermilk Channel, this shoal was carefully swept over and all points of less than the required depth were deepened.

The following table shows the amounts dredged from each channel during the year, the total amounts dredged under the contract, and the estimates of amounts made prior to the appropriation of 1896 and the recently completed contract:

From—	During the past fiscal year.	Total under the contract.	Estimates made prior to contract.
	Cub. yards.	*Cub. yards.*	*Cub. yards.*
Bay Ridge Channel	825, 253	2, 239, 205	1, 980, 814
The triangular area	....	559, 799	411, 000
Red Hook Channel	343, 778	709, 095	537, 300
Buttermilk Channel	675, 379	675, 379	964, 094
Gowanus Canal	....	33, 011	*a* 33, 011
Total	1, 844, 410	4, 216, 489	3, 926, 219

a No estimate made; assumed for comparing totals.

Six dredges were employed under this contract until April, 1899, after which time the area remaining to be dredged became more limited and the number of dredges was reduced.

The appended copy of report upon completion of this contract, dated June 27, 1899, gives further details of character and cost of work done.

The river and harbor act of March 3, 1899, contained a provision for—

> Improving Bay Ridge Channel and Red Hook Channel, in the harbor of New York: Continuing improvement, one hundred thousand dollars: *Provided*, That the work shall be begun at the forty-foot curve at the southerly end of Bay Ridge Channel, and be continued through it along the Brooklyn shore to Twenty-eighth street, until the said Bay Ridge Channel shall have a uniform depth of forty feet at low tide, and a width of one thousand two hundred feet; and the improvement of the Red Hook Channel shall be begun on its southerly end and at its junction with the Bay Ridge Channel, and be continued through it to its junction on its northerly end with the Buttermilk Channel, until said Red Hook Channel shall have been made to a depth of forty feet at low tide, and a width of one thousand two hundred feet: *And provided further*, That contracts may be entered into by the Secretary of War for the completion of said Bay Ridge Channel and Red Hook Channel, to be paid for as appropriations may from time to time be made by law, not exceeding in the aggregate two million four hundred thousand dollars, exclusive of the amount herein and heretofore appropriated.

Proposals for the dredging necessary to complete this work were invited by advertisement and received April 26, 1899. The lowest bid received was at a price too high to secure the completion of the work within the terms of the river and harbor act of 1899, and therefore all the proposals were rejected. The work has been readvertised under conditions differing slightly from those of the previous advertisement, and proposals are to be received July 19, 1899.

PRESENT CONDITION OF IMPROVEMENT.

Bay Ridge Channel has been dredged 800 feet wide and 26 feet deep at mean low water throughout its entire length, and shoals found or formed during the progress of the work have been removed. It now has an available channel of full required depth and of nearly the full width. The banks of this channel are covered with soft mud overlying sand; the mud runs into the channel and the full width can be maintained only by frequent dredging. The bottom of the channel north of Fiftieth street is sand, generally covered with a soft ooze, which has run in since the dredging; below Fifty-fifth street it is mud to a depth of 35 feet or more below low water.

The triangular area has been dredged to a depth of 26 feet at mean low water; the actual dredging was somewhat deeper, to provide against shoaling, and it retains the depth of 26 feet except at the west bank.

Red Hook Channel has been dredged to a depth of 26 feet at mean low water, with width of 400 feet. The side cuts of this channel have shoaled, but the middle retains the required depth.

The bottom of Red Hook Channel is generally sand, quite hard at the north end near its junction with Buttermilk Channel.

Red Hook Shoal, in Buttermilk Channel, has been dredged 26 feet deep at mean low water, from the deep-water channel eastward to 50 feet from the bulkhead. The rapid current prevents any noticeable shoaling in this channel except in the cut close to the bulkhead. The material removed was mainly sand, with clay and stones in places and gravel on the western part of the shoal. The bottom is hard and free from muddy deposit.

PROPOSED OPERATIONS.

Under authority of the river and harbor act of 1899, it is proposed to excavate Bay Ridge and Red Hook channels to a width of 1,200 feet and depth of 40 feet below mean low water, provided offers can be obtained for dredging at a rate sufficiently low to secure the completion of the work within the limits designated by the act of Congress.

Under the terms of the contract it is proposed to require the contractor to begin work within nine months from date of approval of contract, and to work at least ten months in the year at a rate not less than 300,000 cubic yards per month. The contract being not yet awarded, the cost per month can not be definitely stated. Assuming a price of 12 cents, and that work begins May 1, 1900, during the twelve working months ending June 30, 1901, at least $432,000 will be required. This will be $332,000 in addition to the $100,000 appropriated by act of March 3, 1899.

These channels are in the collection district of New York, of which New York City is the port of entry. The nearest light-house is the statue of Liberty Enlightening the World, on Bedloes Island, about 1½ miles west. The nearest work of defense is Fort Columbus, Governors Island, N. Y.

Money statements.

IMPROVING CHANNEL IN GOWANUS BAY, NEW YORK.

BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS.

July 1, 1898, balance unexpended	$391, 789. 57
June 30, 1899, amount expended during fiscal year	337, 644. 04
July 1, 1899, balance unexpended	54, 145. 53
July 1, 1899, outstanding liabilities	42, 165. 58
July 1, 1899, balance available	11, 979. 95

BAY RIDGE AND RED HOOK CHANNELS.

Amount appropriated by river and harbor act approved March 3, 1899	$100, 000. 00
July 1, 1899, balance unexpended	100, 000. 00
Amount (estimated) required for completion of existing project	2, 400, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901	332, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

BUTTERMILK CHANNEL, NEW YORK.

July 1, 1898, balance unexpended	$2, 387. 32
June 30, 1899, amount expended during fiscal year	2, 387. 32

Appropriations for improving Bay Ridge and Red Hook channels, and the triangular area between them, and Buttermilk Channel, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.	
		Buttermilk Channel, including Buttermilk and Red Hook shoals.	Bay Ridge, Red Hook, and Gowanus Creek channels.
Dredging	June 14, 1880	$60, 000	....
Do	Mar. 4, 1881	60, 000	$40, 000
Do	Aug. 2, 1882	60, 000	20, 000
Do	July 5, 1884	10, 000	5, 000
Do	Aug. 5, 1886	56, 250	7, 500
Do	Aug. 11, 1888	100, 000	60, 000
Do	Sept. 19, 1890	....	160, 000
Do	July 13, 1892	100, 000	198, 600
Do	Aug. 18, 1894	50, 000	150, 000
Total	....	496, 250	641, 100
Received from other sources	....	100	....
Total	....	496, 350	641, 100

Total for previous projects, including dredging in Gowanus Canal, $1,137,450.

For present projects.

Application.	Date.	Amount.
Dredging	June 3, 1896	$200, 000
Do	June 4, 1897	350, 000
Do	July 1, 1898	130, 000
Not yet expended	Mar. 3, 1899	100, 000
Total	....	780, 000

Abstract of proposals for dredging Bay Ridge and Red Hook channels, New York Harbor, received April 26, 1899.

No.	Name and address of bidder.	Dredging about 20,405,400 cubic yards scow measurement.		Remarks.
		Price per cubic yard.	Amount.	
		Cents.		
1	American Dredging Co., 236 Walnut street, Philadelphia, Pa.	20	$4,081,080.00	Conditional on dumping near present location of dumping buoy.
2	The W. H. Beard Dredging Co., 18 William street, New York City.	25½	5,203,377.00	
3	R. G. Packard Co., New York City	33⅓	6,801,800.00	
4	The W. H. Beard Dredging Co., 18 William street, New York City.	16¾	3,417,904.50	Conditional on dumping 14 miles from dredging.
5	Morris & Cumings Dredging Co., 17 State street, New York City.	15.15	3,091,418.10	Do.
6	.....do	24.4	4,978,917.60	
7	P. Sanford Ross (Inc.), 277 Washington street, Jersey City, N. J.	17½	3,570,945.00	Conditional on dumping 12 miles from dredging.

NOTE.—Paragraph 10 of specifications has in no case been complied with by the bidders.

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Contract for dredging about 3,000,000 cubic yards from Bay Ridge Channel, the triangular area between Bay Ridge and Red Hook channels, from Red Hook Channel and Gowanus Canal, at 14 cents per cubic yard, measured in scows, and about 1,000,000 cubic yards from Red Hook Shoal, Buttermilk Channel, at 21 cents per cubic yard, measured in scows. Name of contractor, The W. H. Beard Dredging Company, New York City; date of contract, October 6, 1896; date of approval, October 15, 1896; date of beginning work, October 20, 1896; expiration of contract, June 30, 1899; contract completed June 24, 1899.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1897.

Statistics for the year 1898 have not yet been received; the commerce of the past year has not differed materially from that for 1897, when the following figures were reported:

Freight received and shipped by water.

	Amounts.	Estimated value.
Bay Ridge Channel (Sixty-ninth to Twenty-eighth street):	*Tons.*	
Receipts	608,960	$8,829,234
Shipments	135,523	6,177,427
Red Hook Channel (Henry street to Red Hook): Receipts	4,098	32,800
Buttermilk Channel (Red Hook to Atlantic avenue):		
Receipts	5,369,990	237,193,500
Shipments	6,234,600	317,594,000
Total	12,353,171	569,826,961

Vessels, not including tugs or ferryboats.

	Number.	Draft.	Tonnage.
Bay Ridge Channel (Sixty-ninth to Twenty-eighth street):		*Feet.*	*Tons.*
Steam	921	6 to 22	50 to 1,600
Sail	1,094	5 to 20	35 to 1,600
Barges	2,409	6 to 13	75 to 600
Red Hook Channel (Henry street to Red Hook): Sail	12		
Buttermilk Channel (Red Hook to Atlantic avenue):			
Steam	1,435	18 to 29	1,000 to 6,900
Sail	944	12 to 26	500 to 3,000
Barges	33,646		
Total	40,461		

The above includes only freights received and shipped at the docks. The coal business of Red Hook Channel in 1896 is reported in 1897 as done in Gowanus Creek, just above Red Hook Channel. The reports for Buttermilk Channel for 1897 as received gave amounts from Red Hook to the Brooklyn Bridge; they are reduced to a north limit at Atlantic avenue, to compare with previous reports.

In addition to the above, 2,731,433 tons of freight are reported as passing through these channels into Gowanus Creek and Gowanus Canal, carried in 14,825 vessels of 4 to 23 feet draft. Additional freights pass through these channels, the amounts of which there is no means of estimating.

REPORT OF MAJOR H. M. ADAMS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York City, June 27, 1899.

GENERAL: I have the honor to report that the contract for dredging in Bay Ridge Channel, the triangular area between Bay Ridge and Red Hook channels, Red Hook Channel, Buttermilk Channel, and Gowanus Canal, New York Harbor, entered into with the W. H. Beard Dredging Company, October 6, 1896, was completed June 24, 1899.

Bay Ridge Channel, which was 175 to 200 feet wide and 26 feet deep, was widened to 800 feet.

The triangular area was made 900 feet wide at the widest point, as projected. It does not appear of this width because Bay Ridge Channel, shown in the original plans as curved, was straightened on the west edge, including part of the original triangular area.

Red Hook Channel, previously 200 feet wide and 26 feet deep, was widened to 400 feet.

Buttermilk Channel, previously about 680 feet wide, was widened to 1,000 feet, the channel extending to 50 feet from the bulkhead.

The channel of Gowanus Canal, from the foot of Percival street to Hamilton Avenue Bridge, was made 18 feet deep and 55 to 155 feet wide.

This is the work provided for specifically under the river and harbor act of 1896; the channels were dredged to the depth, width, and length, and in the order prescribed by that act.

Early in the progress of the work it was found that the depths made in the several cuts were not permanent. This was partly due to the running in of soft material from adjacent banks where the banks of the cut were high, partly to the scoop of the dippers pushing material over into adjacent cuts, partly to defective appliances for keeping the dredges in position. A dredge with spuds in 26 feet of water (30 feet at high tide) rocks so far that her precise position can not be recovered;

a dredge without spuds, depending solely upon anchor lines, is even worse. It was also found that the channels dredged prior to this contract had not kept their full depth. The shoaling was continuing, and therefore it was expedient to defer removing such shoals until the original work had been completed, except that shoal spots of hard material, not dredged, were taken up as fast as found. The probability of this shoaling had been foreseen, and removal of the shoals was provided for in the contract. After the first dredging over 90 per cent of the area was redredged, removing shoals; parts of Bay Ridge and Buttermilk channels were dredged a third time. In Buttermilk Channel and the upper end of Red Hook Channel the bottom is very hard and the current prevents mud lodging. These channels were carefully swept over, and all lumps of less than the required depth were deepened. In Bay Ridge Channel the bottom is covered with a soft ooze, which has flowed in since the dredging. In some places this has been pushed up by the dredge dippers until it is ½ to 1½ feet shoal. The spots are small, and when found it is not easy to determine their depth, for a sounding pole or lead will sink a couple of feet into the bottom. To keep the channel 26 feet deep this ooze would have to be dredged out every six months. It is not at all necessary; the material is so soft and at present so small in amount that a vessel heavy enough to draw 26 feet would pass through it without change of speed.

The following table shows the originally estimated amounts to be dredged from the several channels, the amounts actually dredged, the prices, and total cost:

	Original estimate.	Actually dredged.	Price.	Cost.
Bay Ridge Channel	1,980,814	2,239,205	$0.14	$313,488.70
Triangular area	537,300	559,799	.14	78,371.86
Red Hook Channel	411,000	709,095	.14	99,273.30
Buttermilk Channel	964,094	675,379	.21	141,829.59
Gowanus Canal	[a] 33,011	33,011	.14	4,621.54
Total	3,926,219	4,216,489	....	637,584.99

[a] No original estimate; amount actually dredged added for total.

The increase in Bay Ridge Channel was due partly to straightening the west line of the channel, and in the three first-named channels it was partly due to removing shoals which had formed during the contract. No sufficient reason is known for the considerable decrease in Buttermilk Channel, but in every case, except the triangular area, the original estimates were balances of previous estimates, made some years previous to the adoption of the project under the act of 1896.

The funds available for this work have been as follows:

Old balance, Gowanus Bay	$1,059.00
Old balance, Buttermilk Channel	2,387.32
Appropriation of 1896	200,000.00
Appropriation of 1897	350,000.00
Appropriation of 1898	130,000.00
Total	683,446.32

Of this amount $637,584.99 has been expended in dredging under contract, and a balance of $12,100 (estimated) remains over and above expenses of inspection, etc., to July 1, 1899. Therefore the expenses incidental to the work, office expenses, supervision, inspection, and examination, have amounted to about $33,760, or about 5.3 per cent of the amount paid for dredging under the contract.

Very respectfully, your obedient servant,

H. M. ADAMS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

F 3.

IMPROVEMENT OF GOWANUS CREEK CHANNEL, NEW YORK.

Gowanus Creek was originally a tidal inlet in the southern part of the city of Brooklyn emptying into Gowanus Bay. This creek has been improved by the United States as part of the improvement of Gowanus Bay, and for the purpose of the improvement the Gowanus Creek Channel has been defined as extending from the junction of the Bay Ridge and Red Hook channels, opposite Henry street, Brooklyn, and Twenty-eighth street, South Brooklyn, eastwardly to the foot of Percival street, that part of the creek east of Percival street being called Gowanus Canal.

In 1880, before improvement by the United States, Gowanus Creek Channel had an available depth of about 11 feet at mean low water.

PROJECTS FOR IMPROVEMENT.

A survey of Gowanus Creek and Bay was made in 1880, and in 1881 a project for improvement was adopted providing for a channel in Gowanus Creek 18 feet deep at mean low water and 200 feet wide, which, with the Gowanus Bay channels, was estimated to cost $182,500. After the depth had been made, under the terms of the river and harbor act of 1888 the project was extended to provide for a depth of 21 feet at mean low water. This depth was made between the harbor lines on either side of the creek under the river and harbor act of 1892, and the project was completed. At the time of completion of the project $491,100 had been appropriated for and expended upon the several channels in Gowanus Bay. It is estimated that about $75,000 of this sum was applied to the Gowanus Creek Channel.

Under the river and harbor act of 1896, appropriating $25,000 for improving Gowanus Creek Channel, New York, by deepening the same to 26 feet at mean low water from the foot of Percival street to its junction with the Red Hook Channel, a project was adopted for making Gowanus Creek Channel 26 feet deep at mean low water, at an estimated cost of $70,000.

The channel was dredged 26 feet deep for width of 125 feet in 1897.

Harbor lines for the part of New York Harbor including Gowanus Creek Channel were established by the Secretary of War March 4, 1890.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

The river and harbor act of March 3, 1899, appropriated $25,000 for continuing improvement. After advertisement, proposals for dredging to widen the channel were received May 3, 1899.

The lowest offer made, 23 cents per cubic yard, was considered too high for the work to be done, and all proposals were rejected.

Offers for doing the required work were again invited by circular letter addressed to each of the bidders under the previous advertisement and to other contractors capable of doing the work. These offers were opened June 12, 1899, and the lowest received, that of Henry S. Beard, at the rate of 14½ cents per cubic yard, was accepted, with approval of the Secretary of War, dated June 28, 1899.

PRESENT CONDITION OF IMPROVEMENT.

Under previous projects Gowanus Creek channel was dredged to 21 feet depth at mean low water between the harbor lines on either side. Under the present project the channel has been deepened to 26 feet for a width of 125 feet.

PROPOSED OPERATIONS.

It is proposed to apply the available funds to widening the 26-foot channel, as contemplated in the approved project.

Gowanus Creek is in the collection district of New York. The nearest light-house is the statue of Liberty Enlightening the World, on Bedloes Island, New York Harbor. The nearest work of defense is Fort Columbus, Governors Island, New York.

Money statement.

July 1, 1898, balance unexpended	$1,041.19
Amount appropriated by river and harbor act approved March 3, 1899	25,000.00
	26,041.19
June 30, 1899, amount expended during fiscal year	88.54
July 1, 1899, balance unexpended	25,952.65
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improving Gowanus Creek Channel, New York Harbor, were made as follows:

Application.	Date.	Amount.
For previous projects: Parts of the appropriations for Gowanus Bay channels, applied to Gowanus Creek, estimated to amount to about $75,000; dredging to 21 feet depth.	Mar. 3, 1881, to July 13, 1892.	$75,000
For the present project:		
Dredging 26 feet deep	June 3, 1896	25,000
Dredging 26 feet deep	Mar. 3, 1899	25,000
Total		125,000

Abstract of proposals for dredging in Gowanus Creek Channel, New York, received May 3, 1899.

No.	Name and address of bidder.	Rate per cubic yard, scow measurement.	Number of cubic yards that can be removed under price bid ($23,000).	Remarks.
1	The W. H. Beard Dredging Co., 13 William street, New York City.	$0.23	100,000	Paragraph 10 of specifications not complied with.
2	Morris & Cumings Dredging Co., 17 State street, New York City.	.25	92,000	Do.
3	Atlantic Dredging Co., 31 Pine street, New York City.	.25	92,000	Do.
4	The International Contracting Co., 95 Broad street, New York City.	.27	85,185	Do.

All bids considered too high and rejected with approval of the Chief of Engineers.

Abstract of bids for dredging in Gowanus Creek Channel, New York, opened June 12, 1899.

No.	Name and address of bidder.	Rate per cubic yard, scow measurement.	Number of cubic yards that can be removed under price bid ($23,000).	Remarks.
1	Henry S. Beard, 13 William street, New York City	$0.14¼	158,621	Lowest bid.
2	John H. Fenner, Fuller Building, Jersey City, N. J	.18¼	124,324	
3	The International Contracting Co., 95 Broad street, New York City.	.26	88,461	
4	Morris & Cumings Dredging Co., 17 State street, New York City.	.25	92,000	

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR, 1898.

These have not been received. The following statement for the calendar year 1897 represents fairly the annual commerce of Gowanus Creek.

Cargoes.

	Tons.	Estimated value.
Receipts: Coal, lumber, steel, and general merchandise	156,964	$1,394,875
Shipments: Miscellaneous	58,388	1,236,877
Total	215,352	2,631,752

Vessels engaged in above commerce.

	Number.	Draft, loaded.	Tonnage.
		Feet.	*Tons.*
Steamers	758	6 to 18	75 to 1,800
Sail vessels	950	4 to 23	100 to 3,128
Barges, etc	3,387	4 to 13	50 to 600
Total	5,095		

The above refers to freight unloaded along Gowanus Creek, and is 5,396 tons less than reported for 1896.

In addition to this there was carried through the creek, to or from Gowanus Canal, 2,083,680 tons of freight, in 7,405 vessels of 4 to 12 feet draft. Also 490,789 tons of coal and lumber was taken into Columbia Basin, just inside the entrance of Gowanus Creek, there to be assembled into tows and dispatched to destinations; this was reported as in Red Hook Channel in 1896.

No new lines of transportation are reported as established since July 1, 1897.

F 4.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. *Steamship Alvena.*—The British iron steamship *Alvena* sunk in New York Harbor in the angle between Gedney and South channels, after collision with the steamer *British Queen*, January 19, 1897. She lay in about 25 feet depth of water, and was a serious danger to navigation.

A contract for removal of the wreck was entered in July 15, 1897, with John W. Chittenden, the work to be completed by November 24, 1897, at cost of $36,000. On September 23, 1897, a supplementary agreement was entered into with the contractor, providing for sale to him of materials recovered from the wreck for $2,200, to be deducted from the contract price.

The contract was extended to November 24, 1898, the work being much delayed by fog, storms, and the rapidity of the tidal current.

July 1, 1898, about 60 per cent of the wreck had been taken out and work of removal was in progress.

Work was continued until November 3, 1898, when the removal of the wreck was completed.

Payment for this work has been delayed pending decision of the Treasury Department upon the contractor's claims regarding penalty clause in the specifications.

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1899, FOR REMOVAL OF WRECK OF STEAMSHIP ALVENA.

Name of contractor: John W. Chittenden.
Date of contract: July 15, 1897.
Date of approval of contract: July 27, 1897.
Date of beginning work: August 4, 1897.
Expiration of contract, under extension: November 24, 1898.

Articles of agreement supplementary to the above, providing for sale of materials recovered for the sum of $2,200, to be deducted from the contract price, dated September 23, 1897; authorized by the Secretary of War September 17, 1897.

2. *Barge Samuel E. Spring.*—The coal barge *Samuel E. Spring* was struck by the Wilson Line steamer *Buffalo*, on October 1, 1898, and sunk in about 30 feet of water, near the middle of the main channel, New York Harbor, abreast of Black Buoy No. 9.

Proposals for removal were invited, and the lowest offer received, that of the Merritt & Chapman Wrecking Company, to remove the wreck for $6,800, was accepted November 2, 1898. Work was begun immediately and the removal was completed in February, 1899. The wreck was raised, towed away, grounded, and secured on private property inside the established bulkhead line at Tompkinsville, Staten Island, N. Y.

3. *Canal boat Donnell.*—This was an abandoned canal boat found adrift in the North River, New York Harbor, in November, 1898. The boat was worthless and a danger to navigation and her owner could not be found.

The removal of the boat was authorized, bids were invited by circular letter, and the lowest received, that of the Baxter Wrecking Company, to remove the wreck for $120, was accepted November 19, 1898. The wreck was at once secured and disposed of by placing her above low water inside the bulkhead line on the property of the contractor at Weehawken, N. J.

4. *Tugboat Col. Grubb.*—The dismantled tugboat *Col. Grubb* had been lying at the dock of the Greenpoint Towage and Lighterage Company, in Newtown Creek, since some date prior to April, 1897. In October, 1898, the hulk slipped off into the channel and sunk in 18 feet of water, where it was an imminent danger to navigation.

The removal of this wreck was authorized, and proposals for the work were invited by circular letter. The lowest offer received, that of John T. Baxter, amount $239, was accepted. The wreck was lifted by pontoons, December 8, 1898, and disposed of by grounding it at low tide on the contractor's property, inside the established bulkhead lines at Weehawken, N. J.

5. *Dump scow in New York Harbor, south of Governors Island.*—A dump scow, with a load of mud for the dumping ground outside the harbor parted her towlines in the night, and sunk in 25 feet of water south of Governors Island, New York Harbor. The first report received of this wreck was on occasion of a coal barge grounding upon it.

An allotment for removal of the scow was made and the removal was authorized as soon as legal evidence of abandonment could be procured. The location of the scow having been learned by the owners, the Atlantic Dredging Company, the wreck was removed by them and towed away, December 30, 1898, without expense to the United States.

6. *Barge Narcissus.*—The oil barge *Narcissus* while discharging cargo at the bulkhead, foot of Wolcott Street, Brooklyn, in December, 1898, sunk; subsequently she parted her lines and slipped off the bank into Buttermilk Channel, where she lay in 26 feet depth of water.

Proposals for removal were invited by circular letter and the lowest offer received, that of the Baxter Wrecking Company, in sum of $396, was accepted. The wreck was lifted and disposed of by depositing on the private property of the contractors, behind the bulkhead line, at Weehawken, N. J., March 18, 1899. Nothing of value was found upon the wreck.

7. *Canal boat Fox.*—The *Fox* was a canal boat which had been wrecked and abandoned on the mud flats east of the channel of Bronx River, New York. During the winter of 1898-99 ice carried the wreck into the channel where it lay an obstruction to navigation. Proposals for removal of the wreck were invited. The lowest offer received was that of the Baxter Wrecking Company to completely remove the wreck for $419. This offer was accepted April 3, 1899, and the wreck was lifted and towed away April 11, 1899, and deposited in the yard of the contractors behind the established bulkhead line at Weehawken, N. J.

8. *Schooner Wm. Everett.*—This schooner, with a cargo of brick, anchored behind the breakwater at Greenport, Long Island, N. Y., dragged her anchors during a snow storm, drifted across Shelter Island Sound, and came into collision with the dock at Prospect Landing, Shelter Island, and sunk in deep water in the vicinity, where her spars were a danger to the small craft navigating those waters. Examination of the wreck was made and it was learned that the owners had arranged with a wrecking company to recover the boat. The schooner was raised and towed to the owner's dock at Greenport in May, 1899. The only expense incurred by the United States was $4.33 for examination of the wreck.

9. *Barge David Crockett.*—The three-masted coal barge *David Crockett*, entering New York Harbor February 14, 1899, with load of coal, grounded and sunk on the east end of Flynns Knoll, about 1 mile north of Sandy Hook, and in water from 15 to 20 feet deep. The cargo was partly removed by the owners and the barge abandoned.

The wreck lay outside the main channel and in a location where, being visible above high-water level, she was not a source of immediate danger to navigation; but she was liable to be broken up, particularly in winter, and to be carried into the main channel. The removal of the wreck was authorized June 6, 1899, work to be done during the more favorable summer months.

Proposals for the removal of the wreck have been invited by advertisement, to be opened July 28, 1899.

F 5.

SURVEY OF THE EAST CHANNEL, NEW YORK HARBOR, FROM THE NARROWS TO THE SEA.

[Printed in House Doc. No. 159, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 16, 1899.

SIR: Joint resolution of Congress, approved January 12, 1899 (Public resolution No. 7), directs the Secretary of War "to submit a report of survey and estimate for the improvement of the east channel in New York Harbor from The Narrows to the sea, and for the enlarging of the same to the depth of thirty-five feet and a width of one thousand five hundred feet, and to also report upon the desirability of such improvement."

To enable the Secretary to comply with the provisions of this resolution, I have the honor to submit the accompanying copy of report, dated December 16, 1898, by a Board of Engineers, in relation to the subject.

It is the opinion of the Board that a channel at least 35 feet deep at mean low water and 2,000 feet wide should be provided, and that, for reasons stated in the report, the East Channel should be the one to be dredged. It is estimated that a channel of such dimensions would cost $4,510,000, but in view of the anticipated construction of vessels of deeper draft, resulting in diminished cost of transportation, the Board is of the opinion that the proposed channel should ultimately be deepened to 40 feet, and submits an estimate therefor amounting to $6,688,000.

The resolution calls for an estimate for a channel 35 feet deep and 1,500 feet wide, while the report and estimate of the Board are for a channel 2,000 feet wide. Detailed information regarding the narrower channel is not at hand, but it can be considered as approximating three-fourths of the cost of the 2,000-foot channel.

The views of the board are concurred in by me.

There is also submitted herewith a copy of a report, dated April 5, 1898, with map,[1] by Lieut. Col. William Ludlow, Corps of Engineers, (now major-general, U. S. Volunteers), upon survey for obtaining a main ship channel from the Narrows to the sea, with a depth of 35 feet at mean low water.

It may be said in explanation that the Board, whose report is submitted herewith, was constituted, by authority of the Secretary, for the purpose of considering and reporting upon the above-mentioned communication of General Ludlow, and that the communication of December 16, 1898, herewith, is the Board's report thereon.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

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[1] Not reprinted. Printed in House Doc. No. 159, Fifty-fifth Congress, third session.

REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, N. Y., December 16, 1898.

GENERAL: The board of engineers convened by Special Orders, No. 22, headquarters, Corps of Engineers, September 12, 1898, to consider and report upon the question of securing a channel of adequate depth and width to accommodate the commercial interests centering at the port of New York, have the honor to submit the following report:

The Board met pursuant to the call of the senior member in this city December 16, and carefully considered the reports and maps of the recent surveys made in accordance with the last river and harbor act.

The deepest draft of steamers which now make use of the harbor is 32 feet, and it is stated by steamship agents that larger vessels are under construction, which will draw, when loaded, as much as 33 feet. A list of deep-draft vessels is appended. For vessels of this class a channel at least 35 feet deep at mean low water and 2,000 feet wide should be provided.

The Board is further of the opinion that the East Channel should be the one to be dredged, for the following reasons:

First. Shorter distance.—The course between New York and the ocean is 5 miles less by way of East Channel than by way of Main Ship Channel.

Second. Avoiding sharp bends.—In East Channel the bends are slight. Between the south end of main ship channel and west end of Bayside Channel is a bend of about 115° in a distance of 6,000 feet. In unfavorable conditions of currents, winds, and low water it is not easy for a deep-draft vessel, with keel near the bottom, to turn within narrow limits.

Third. Straight currents.—In East Channel the currents are straight, or nearly so, as far as observations show. In Gedney and Bayside channels they are about true, but in Main Ship Channel they are cross. The cross currents, however, are not strong, even at maximum.

The following estimate for a channel 2,000 feet wide and 35 feet deep is submitted:

Four dredges, at $200,000 each	$800,000
Dredging 33,000,000 cubic yards, at 10 cents	3,300,000
Add for contingencies 10 per cent	410,000
Total	4,510,000

The reported cost of recent work of dredging at the mouth of the Mersey, the entrance to Liverpool Harbor, is less than this, but it is doubtful if contractors in this country will undertake the work for less than the estimated cost.

In view of the construction of vessels of deeper draft, which diminish the cost of transportation, the Board is of the opinion that the proposed channel should ultimately be deepened to 40 feet, and the following estimate of cost is submitted:

Four dredges, at $200,000 each	$800,000
Dredging 52,800,000 cubic yards, at 10 cents	5,280,000
Add for contingencies 10 per cent	608,000
Total	6,688,000

HENRY M. ROBERT,
Colonel, Corps of Engineers.
C. W. RAYMOND,
Lieut. Col., Corps of Engineers.
H. M. ADAMS,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

Vessels of 30 feet draft or over passing out over Sandy Hook Bar, January 1 to December 3, 1898.

Name of steamship line.	Name of vessel.	Number of trips.	
		30 feet draft or over.	Maximum draft.
			Ft. in.
Hamburg-American Line	Palatia	1	30 6
	Pretoria	7	31 6
	Phœnicia	1	30 0
	Pennsylvania	4	32 0
	Brasilia	1	30 0
	Patria	1	30 8
	Bulgaria	5	32 0
American and Red Star Line	Southwark	2	30 2
White Star Line	Cymric	3	30 8

Number of vessels 9
Number of trips out 25
Maximum draft .... feet.. 32

The following steamers of estimated draft 30 feet or over are reported building:
Red Star Line, 2 steamers, estimated draft 30 feet +; ready in 1900.
White Star Line, 3 steamers, estimated draft 30 feet +; ready in 1899.
Hamburg-American Line, 5 steamers, estimated draft 30 feet +; ready in 1899.
Atlantic Transport Line, 4 steamers, estimated draft 31 feet to 33 feet; ready in 1899.
Cunard Line, 2 steamers, estimated draft about 30 feet; ready in 1899.

REPORT OF LIEUT. COL. WILLIAM LUDLOW, CORPS OF ENGINEERS (NOW BRIGADIER-GENERAL, UNITED STATES VOLUNTEERS).

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., April 5, 1898.

GENERAL: I have the honor to submit the following preliminary report of the resurvey of New York Harbor, made pursuant to the act of June 3, 1896, which called for surveys and estimates of the cost of obtaining a main ship channel from The Narrows to the sea, with a depth of 35 feet at mean low water.

The late date at which the organization of the field party was finally effected and the delay due to unfavorable weather during the fall months into which the survey was necessarily prolonged have made it impracticable to procure the complete data required for a full discussion, and the pressure of other urgent matters requiring attention at this time prevents making entire use of the material collected. The remaining information, however, principally borings, can be readily supplied later and is not essential to the statement of the cost of securing the channel in question, and the fuller report can be hereafter prepared in time for incorporation in the next annual report.

For the detail particulars of the survey, I beg to refer to the accompanying preliminary report by Mr. Stierle, assistant engineer, who has had charge of the work under my direction, and whose prolonged experience in studies of this kind lend value to his statements. The accompanying chart has been drawn on a scale of 1 to 20,000, and by use of colors for the submerged contours exhibits clearly the hydrographic conditions and status of the harbor entrance. The width of the opening between Sandy Hook and Coney Island is 7 miles, and the green contours of 12 feet depth, indicating the several banks of shoals which separate the ocean from Raritan Bay, show the general position of the crest of the main bar. This bar is traversed by several channels of varying nature and depth, which represent the resultants of the numerous and complex hydraulic and tidal conditions affecting the entrance.

The Coney Island Channel, close under the land, has all the characteristics of a flood-tide channel; that is, a channel mainly controlled by the action of the flood current. These features are the gradual shoaling of the channel from the sea and the existence of a bar at its inner end. The 14-foot channel is mainly an effect of the ebb tide, the force of which is lost soon after crossing the main crest of the bar.

The East Channel is a well-marked result of the ebb current, and carries to sea the greater proportion of the outflow from the Upper Bay and the Hudson River Basin through The Narrows. It is, in fact, the old bed of the Hudson River, and maintains naturally a broad channel of over 30 feet depth for a distance of 4½ miles below the 35-foot contour of the deep water south of The Narrows, passing completely through the main crest of the bar, and leaving an interval of 1¾ miles between the lower or sea end of the 30-foot channel and the corresponding contour on the ocean floor. This interval constitutes the bar in the East Channel.

The Swash Channel is a subsidiary channel or cut-off, lying between the East and Bayside channels and partaking of both ebb and flood characteristics. It crosses the latter channel at a considerable angle, and its natural prolongation seaward is designated the South Channel.

The Bayside Channel forms a deep pool off the north end of Sandy Hook, due mainly to the powerful outflow of the tidal prism of Raritan Bay, which is crowded southward by the general ebb movement from The Narrows.

Its continuation to sea is by means of the Gedney Channel, which is partly artificial—that is, has been deepened by dredging. After entering by the Gedney and traversing the Bayside Channel the course of vessels bound for New York is by means of a narrow and partially artificial channel northward from the Southwest Spit to the deep water below The Narrows.

This last channel is at nearly right angels with the general movement into and out of Raritan Bay, and, in consequence of the tides crossing it, there is a constant tendency to fill, and the full depth can be maintained only by dredging.

Between Southwest Spit and Sandy Hook there is also a marked and general tendency to form a bar obstructing the Bayside Channel, which requires frequent attention from the dredge. This shoaling is due to the gradual westward extension of Sandy Hook and the effect of the flood current sweeping around the point of the Hook and depositing sand under its lee.

At the present time the Main Ship Channel enters the Gedney, turns the angle into the Bayside, turns an acute angle again around Southwest Spit, and thence goes northward to The Narrows. As is shown by the red contours of 30 feet depth, the 30-foot channel is continuous throughout the course indicated, though in several places the 30-foot contours are less than 1,000 feet apart. The distance from the 35-foot contour below The Narrows to the same contour at sea outside the Gedney is 11¼ miles, the channel widths and depths varying greatly over this distance, about 8 miles of which, to a greater or less extent, require dredging for deepening and maintenance.

When the improvement of the New York entrance to 30 feet at mean low water was undertaken, in 1884, the original appropriation was specifically for deepening the Gedney Channel, without prior report by the engineers of the War Department.

The Gedney being specified by the act left the choice of a continuance of the deepened navigation, either by the Swash or by following the Bayside to Southwest Spit and thence northward. The characteristics of the Swash—its narrowness and lumpiness and its close vicinity to the Romer, which is the shoalest place on the main crest of the bar—discouraged its adoption as a main channel; and in addition the question of military defense and the expediency of bringing heavy vessels under the guns of Sandy Hook were considerations not without weight.

At this time, with a new proposition to make a 35-foot low-water navigation, the act does not restrict the consideration of the general subject of location, and the important question at the outset is as to where the future channel should be made, so as best to meet requirements, conserve the interests concerned, and produce the most advantageous results with the least expenditure of time and money and the best guaranty for future maintenance.

There is no question, in my judgment, that the East Channel is in nearly every respect the most favorable. It is the natural main outlet for the ebb tide through The Narrows and the deepest and widest natural channel across the bar. By virtue of its powerful discharge and the directness and uniformity with which the tidal currents, both of ebb and flow, traverse it, the East Channel has always maintained its natural superiority without artificial aid, and has in fact pushed its deep contours seaward and somewhat deepened its passage over the bar at the outer end, notwithstanding the artificial widening and deepening of the Main Ship Channel.

To open this channel to the sea is a comparatively simple task, and a comparison of the quantities of dredging involved in deepening the East Channel to 35 feet, with a width of 2,000 feet, and of effecting the same enlargement of the present ship channel shows a materially less amount in the former case, with the advantage that most of the dredging will be done at the outer end, near the place of deposit at sea, and with the special advantage of greatly increased probabilities of maintenance, and hence a notably diminished cost on this account. I have, therefore, no hesitation, from the engineering and economic standpoint, in recommending the East Channel as the best location for the main ship channel of entrance to New York Harbor.

From the commercial standpoint the advantages are even more conspicuous. The East Channel is at once the most direct, the shortest, and the most commodious, and the tidal currents, both ebb and flood, run true. The distance between the 35-foot contours, inside and outside, is 6¼ miles—5 miles less than by the present ship channel. The straight axis of 4 miles of its sea end, as drawn on the chart, can be marked by a light-house on its prolongation on West Bank, and the subsidiary lighting would offer no difficulty. The upper entrance is given a funnel shape, enlarging by a gradual curve from the straight portion 2,000 feet wide into the deep-water section above, with a width of over 4,000 feet.

The total quantity to be dredged from the East Channel to make a channel 2,000 feet wide and 35 feet deep at mean low water, including allowances of 1 foot overdepth, side slopes of 10 to 1, and 25 per cent added for difference between scow and place measurement and for the wash and filling in during construction, is 29,100,000 cubic yards. The material is sand, gravel, and mud, all readily dredged by pumping.

These materials, with suitable appliances, have been removed and deposited at from 3¾ to 7 cents, according to circumstances.

In the case of New York Bar the dredging steamer deepened the Gedney Channel at a cost of about 5 cents, the work on the interior channels costing about twice that. I have therefore used 7½ cents, with 10 per cent added for contingencies, as a reliable unit price for the East Channel work on the scale in question.

For the construction of the channel powerful dredges are desirable, both for economy and expedition, and I have allowed for four of these, which would make the channel completely in from two and one-half to three years, and by reason of the greater natural depth of the north half of the channel as designed could open it for a width of 1,000 feet and depth of 35 feet in about one and one-fourth years.

The estimate therefore stands as follows:

Dredging 29,100,000 cubic yards, at 7½ cents	$2,182,500
Contingencies, 10 per cent	218,250
	2,400,750
4 pump dredges, at $200,000	800,000
Total	3,200,750

This sum represents estimated net cost at prices that are ample to cover all expenditures. If the work be given out at contract an increase of about 20 per cent should be allowed, and the total would be $3,840,900.

If the United States do the work the contractors' profit will be saved, and the dredges will remain public property. Upon completion of the channel one of the four could be retained for maintenance, and the remaining three assigned to other work.

An incidental advantage of opening the East Channel would be the freedom from interference by vessels, as the present ship channel would be maintained while work was in progress in the East Channel. As heretofore indicated, all the circumstances favor the East Channel with the exception possibly of the military defense question.

The East Channel lies about midway between Coney Island and Sandy Hook, and is, therefore, on the average, about 3½ miles distant from either—range fully within reach of modern ordnance, but somewhat greater than has been regarded desirable in connection with torpedo defense, and the protection of the torpedo fields from interference. But this objection can be met by special means, and it is quite likely in any case that the Romer may be occupied hereafter by a suitable armament, when the objection would be entirely relieved. Furthermore, as a general proposition, since hostilities are abnormal and exceptional, and commerce is habitual and constant, it seems evident that in an instance such as the most important and valuable harbor in the country, the maintenance of whose commerce is vital, the dispositions as to the channels of entrance and exit should be such as to facilitate to the utmost the movements and security of shipping, even if some disadvantage should accrue to the details of a military defense.

Your obedient servant,

WILLIAM LUDLOW,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 6, 1898.

Respectfully submitted to the Secretary of War.

The river and harbor act of June 3, 1896, provides for survey of New York Harbor from The Narrows to the sea, with a view of obtaining 35 feet at mean low-water mark, and under this provision of law a report and estimate prepared in January, 1897, by Col. G. L. Gillespie, Corps of Engineers, the officer then in local charge of improvement of New York Harbor, was submitted to Congress, and is printed in House Doc. No. 243, Fifty-fourth Congress, second session, and in the Annual Report of the Chief of Engineers for 1897, pages 1053 et seq.

After this report was presented it was thought advisable that the creation of a new channel, differing in location from that now in use, and other portions of the subject should have some further consideration, and Lieut. Col. William Ludlow, Corps of Engineers, the successor of Colonel Gillespie, prepared and submitted the within report of the results of a survey of the locality mentioned.

The question of securing a channel of adequate depth and width to accommodate the vast commercial interests centering at the principal port of the United States is one of paramount importance, and while it is questionable whether, in view of the provisions of section 4 of the river and harbor act of June 3, 1896, this second report on the subject of the survey mentioned can be properly submitted to Congress without further legislative action, it is certainly desirable that this office be in possession of all important and available data respecting the channel approach to the city of New York, and in my judgment the matter should receive the careful consideration of a Board of Engineer Officers in order that the fullest attainable information may be accessible to the committees of Congress.

I have the honor therefore to recommend that these papers be referred to such a board for consideration and report, the board to consist of Col. H. M. Robert, Corps of Engineers; Lieut. Col. C. W. Raymond, Corps of Engineers, and Maj. H. M. Adams, Corps of Engineers.

With the sanction of the Secretary the order constituting the board will be issued by his direction from this office.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
September 8, 1898.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War:

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 13, 1898.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, for consideration and report by the Board of Engineers constituted by Special Orders, No. 22, headquarters, Corps of Engineers, September 12, 1898, of which he is the senior member.

The Board is authorized to call upon the local officer for any previous reports it may desire or for any additional information deemed necessary, and the expenses of the Board will be paid by Maj. H. M. Adams from appropriation for improving New York Harbor, New York.

It is desired that this subject receive that thoughtful and careful consideration which its importance demands, and that the report of the Board be submitted at the earliest practicable date consistent with the other duties devolving upon the members of the Board, and with proper consideration of the important questions involved.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Fourth indorsement.]

ARMY BUILDING,
New York City, December 17, 1898.

Respectfully returned to the Chief of Engineers, inviting attention to inclosed report of this date.

HENRY M. ROBERT,
Colonel, Corps of Engineers.

REPORT OF ASSISTANT ENGINEER A. STIERLE.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., March 31, 1898.

SIR: I have the honor to submit the following preliminary report upon the survey of New York Harbor from The Narrows to the sea, with a view of obtaining 35 feet at mean low water, which was made under your direction:

The organization of the field party was completed about July 1, pursuant to authorization by the Chief of Engineers, dated June 28, and after the necessary preparations had been made, such as chartering boats, erecting tide gauges, etc., active operations were begun on July 7.

The information to be brought out by the survey was to embody principally all changes, if any, in the hydrography between The Narrows and the 40-foot contour outside the bar; the prevailing direction of the tidal wave and its rate of propagation by tidal observations at several points; the direction and volume of currents across the bar; all changes in the shore lines adjacent to the bar, Sandy Hook, and Coney Island, respectively; and the determination of the character of the bottom by borings along and in the vicinity of the East Channel.

As the season most favorable for such work was already well advanced, it required unremitting attention to make the best use of the time remaining before rough weather should set in. The progress of the survey was further delayed by frequent squalls during the summer and a series of windy days during the fall, so that not until December 1 was the work sufficiently advanced to permit of disbanding the field party.

The data obtained by the survey are less complete than is desirable, especially those relating to current observations and borings, which, however, can be supplemented later. Meanwhile it is of importance to embody in the present report all such observations and deductions noted since the recent chart has been plotted which are of general interest and which will directly affect proposed improvements.

The area covered by the survey extended eastward to about the meridian of Rockaway Inlet; westward to include Old Orchard Shoal, the West Bank, and The Narrows; southward, in the bay as well as offshore, to the latitude of Horseshoe Cove, Sandy Hook, and northward to The Narrows, a total of about 80 square miles. Soundings were first taken over the whole ground along lines running as nearly as practicable east and west and north and south, followed later by special examinations of each channel, with the number of soundings greatly increased and the courses of the boat held closer together. In all, 18,000 soundings were taken, and as every alternate one was located by two sextant angles, the number of angles observed is about the same. For reduction to mean low water the established plane at the engineer wharf at Sandy Hook was used, to which also all other tide gauges set up in the upper part of the bay were referred, proper cognizance being taken at certain stages of the tide, particularly during the ebb, of the prevailing slope.

Shortly after the survey was begun certain members of the field force were detailed for special work on shore during days too unfavorable for work on the water. This party succeeded before the season was over in making a complete detailed survey of the portion of Sandy Hook situated north of Horseshoe Cove, and of the entire south shore, including adjacent topography, of Coney Island.

A chart embodying the results has been plotted to a scale of 1:20,000—the same scale as that of the survey of 1884, to permit of an easy comparison. This information was subsequently enlarged in part to a scale 1:5,000 for special purposes, the reductions, each on a separate sheet, covering the whole of the East Channel, the northwest shoal in Bayside Channel, the so-called Coney Island Channel, and the hydrography around the northern part of Sandy Hook. Detailed maps of the surveys of Sandy Hook and Coney Island were also plotted upon the same scale—1:5,000.

Continuous tidal observations were made throughout the survey at Horseshoe Cove, Sandy Hook, and Fort Hamilton, the registering being done by automatic tide gauges. These observations are still continued. A tide record was also kept at Old Orchard Shoal Light-House for three months, and occasionally at the engineer wharf, Sandy Hook, at Norton Point, Coney Island, and at Swinburn Island. The notes have been compiled and are now in preparation to be tabulated. They have received a valuable addition, covering the period of our observations, in the records of an automatic tide gauge at the United States light-house depot, Staten Island.

Comparing the present chart with that of 1884, a tendency to shoaling is shown by the soundings along the west side of the Main Ship Channel north of Southwest Spit. There are unmistakable indications that the shoal in the Bayside Channel northwest from Sandy Hook is re-forming, the width of the dredged channel having been reduced and the depth diminished since dredging was suspended in 1895. Considerable shoaling has taken place on the west side of the point of Sandy Hook, due to a westerly extension amounting to 1,270 feet since 1884. There is apparently a tendency to connect with the northwest shoal, and thence with Southwest Spit across the present main channel. The Gedney Channel seems to have fairly maintained its depth. The shoal called the False Hook, outside Sandy Hook, has deepened. False Hook Channel, however, remains the same. The Romer Shoal and Swash Channel show only slight changes confined to locally small areas. The East Channel deepened at the outer end near the bar and over the latter. The crest of the east bank, and, in fact, those of all shoals north of the East Channel up to the Coney Island shore, show more water than formerly, but have shifted southward. The middle portion of Fourteen-foot Channel has shoaled and also moved southward. In the deep-water pocket between Rockaway Inlet and the east bank all contours deeper than 18 feet have moved out considerably; in some places, where over ten years ago the depth was 30 feet at mean low water, it is now only 20 feet. This change may be directly attributed to the enormous quantities of city refuse being dumped in this vicinity.

The western end of Coney Island has extended westward about 280 feet since 1884, but in other respects the Coney Island Channel is substantially unchanged.

Current observations were made during the few calm days that occurred while the survey was in progress opposite Gravesend Bay, near eastern side of the Main Channel, in the Coney Island Channel, in the East Channel, and in the Main Ship Channel opposite Sandy Hook. The observations were carried on in each case throughout a full run of a tide with submerged floats suspended at middepth. The results were subsequently reduced to a mean stage of the tide, and from these, together with observations made by the Engineer Department and the Coast Survey on previous occasions at other points, the mean velocity of both flood and ebb current for each channel was determined. The cross sections of the channels were measured along a line joining the shoalest points of the adjacent bars. It was found that during the ebb current—the one which principally forms the channels—the East Channel has the greatest mean velocity, viz, 1.91 feet per second, and that the Bayside Channel is next, with a mean velocity of 1.63 feet per second. The mean velocity during flood is slightly larger in the last-named channel than in the East Channel, being, respectively, 1.70 and 1.65 feet per second. The velocity curves were plotted upon one sheet, together with a tidal curve representing the mean rise and fall of the tide at Sandy Hook. This diagram shows the velocity in any channel at any moment with reference to the stage of a normal tide at Sandy Hook, and illustrates the momentum, gained by a free movement, of the ebb and flood currents in the East Channel, both continuing for a considerable period after the currents in the channels have become slack.

It would be well to supplement these current observations with an additional series taken in the fourteen-foot channel, and probably in the two subsidiary channels just north of it, as without these no accurate estimate of the whole discharge over the bar can be made. The Coast Survey[1] estimated the total discharge in

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[1] Report for 1871, p. 110; ibid. for 1886, Appendix 13.

1858 at 27,663,000,000 cubic feet, modified in 1872 to 26,756,000,000 cubic feet, which estimate included the tidal prism of Newark and Raritan bays and the Kills and the Hudson and part of East River. Adopting for comparison 27,000,000,000 as a basis, the gap in our observations can be easily filled, and the resulting discharge, expressed in percentage of the whole, is as follows: Main Ship (Bayside) Channel, ebb 19 per cent, flood 22 per cent; East Channel, ebb 26 per cent, flood 24 per cent.

As directed, I have made an estimate of the amount of material to be removed from the East Channel, based upon data of the recent survey, for a channel 2,000 feet wide and 35 feet deep at mean low water along the lines shown on the accompanying chart. The net amount of the prism in place, inclusive of 1 foot overdepth and side slopes of 1 to 10, is 23,266,240 cubic yards. Adding 25 per cent for filling in of material from the adjacent shoals during the progress of dredging or during temporary stoppages of the work, and for increase in bulk to reduce to scow measurement, the gross amount of material to be removed is 29,100,000 cubic yards.

The material at the outer end of the channel, where the deepest cutting is to be done, consists of sand and gravel, in places mixed with mud; within the channel inside the bar it is mostly mud and sand. These characteristics of the bottom were ascertained by soundings with the water jet, extending at several points to a depth of 40 feet below mean low water. The material to be dredged can be readily removed with suction dredges.

For the past five years a suction dredge of improved type has been at work on the Mersey Bar, England, having an average working capacity of about 1,000 cubic yards per hour, including the time occupied in transporting and unloading the dredged material. On one occasion the rate per hour has been 1,325 cubic yards. Allowing that throughout the year one-third of each month, on an average, is lost by bad weather, it would require one such dredge about ten and one-half years to complete a 35-foot channel. This time could of course be materially reduced by using more powerful dredges on the work and more of them. The prism of the northern half of the proposed channel is about 18 per cent smaller in cubical contents than that south of the axis. There should be no difficulty in opening that half of the channel for its full width of 1,000 feet and to a depth of 35 feet at mean low water within five years if a single dredge of the capacity described above is put to work therein, or, with a full force of four machines, within one and one-quarter years.

Estimate of cost of proposed new channel, 2,000 feet wide and 35 feet deep at mean low water, following the direction of the present east channel.

Dredging 29,100,000 cubic yards, at 7½ cents	$2,182,500
Contingencies, 10 per cent	218,250
	2,400,750
Cost of four dredges, at $200,000 each	800,000
Total	3,200,750

Very respectfully, your obedient servant,

A. STIERLE, *Assistant Engineer.*

Lieut. Col. WILLIAM LUDLOW,
Corps of Engineers.

APPENDIX G.

IMPROVEMENT OF RIVERS AND HARBORS IN VERMONT, OF NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT, OF HUDSON RIVER, NEW YORK, AND HARBORS THEREON, AND OF RIVERS AND HARBORS IN NORTHEASTERN NEW JERSEY.

REPORT OF COL. J. W. BARLOW, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Burlington Harbor, Vermont.
2. Otter Creek, Vermont.
3. Narrows of Lake Champlain, New York and Vermont.
4. Hudson River, New York.
5. Saugerties Harbor, New York.
6. Rondout Harbor, New York.
7. Peekskill Harbor, New York.
8. Passaic River, New Jersey.
9. Channel between Staten Island and New Jersey.
10. Elizabeth River, New Jersey.
11. Raritan River, New Jersey.
12. South River, New Jersey.
13. Raritan Bay, New Jersey.
14. Matawan Creek, New Jersey.
15. Keyport Harbor, New Jersey.
16. Shoal Harbor and Compton Creek, New Jersey.
17. Shrewsbury River, New Jersey.
18. Manasquan (Squan) River, New Jersey.
19. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
New York City, July 14, 1899.

GENERAL: I have the honor to forward herewith annual report upon works of river and harbor improvements in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

J. W. BARLOW,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

G 1.

IMPROVEMENT OF HARBOR AT BURLINGTON, VERMONT.

The improvement of this locality consists in forming an artificial harbor in front of the city by constructing a breakwater about 1,000 feet from the shore.

A description of the locality and a history of the work done can be found in the Annual Report of the Chief of Engineers for 1897, pages 3296 and 3297.

No work was done during the fiscal year, as no funds were available when the water was at a low enough stage to permit of work being done.

The money appropriated by act of March 3, 1899, will be applied to building a concrete or concrete-and-stone superstructure on a portion of the breakwater.

Money statement.

July 1, 1898, balance unexpended	$206.42
Amount appropriated by river and harbor act approved March 3, 1899	15,000.00
	15,206.42
June 30, 1899, amount expended during fiscal year	33.98
July 1, 1899, balance unexpended	15,172.44
Amount (estimated) required for completion of existing project	215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

By act of—		By act of—	
July 4, 1836	$10,000.00	August 14, 1876	$20,000.00
March 3, 1837	10,000.00	June 18, 1878	20,000.00
July 7, 1838	50,000.00	March 3, 1879	15,000.00
June 11, 1844	10,000.00	June 14, 1880	10,000.00
August 30, 1852	10,000.00	March 3, 1881	10,000.00
May 19, 1864	308.00	August 2, 1882	12,000.00
June 28, 1864	13,500.00	July 5, 1884	50,000.00
June 23, 1866	27,672.20	August 5, 1886	18,750.00
March 2, 1867	80,000.00	August 11, 1888	35,000.00
July 11, 1870	25,000.00	September 19, 1890	20,000.00
March 3, 1871	30,000.00	August 18, 1894	10,000.00
June 10, 1872	30,000.00	June 3, 1896	10,000.00
March 3, 1873	25,000.00	March 3, 1899	15,000.00
June 23, 1874	25,000.00		
March 3, 1875	25,000.00	Total	617,230.20

NOTE.—In 1872, $6,669.13 was carried to surplus fund and not expended.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Registered tonnage.	Trips made.
Steam	13	20 to 1,011	489
Sail	9	38 to 96	130
Canal boats and barges	240	60 to 175	412

Greatest length, 261 feet; greatest draft, 10 feet.

Freight handled.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal	71,888	44,597	43,352
Lumber and timber	23,193	36,342	36,702
Stone, gravel, and sand	18,126	2,079	11,281
General merchandise	32,774	26,162	25,192
Total	145,981	109,180	116,527

Passengers carried, 91,813.

G 2.

IMPROVEMENT OF OTTER CREEK, VERMONT.

This improvement was undertaken in order to provide an 8-foot channel, 100 feet wide, from Lake Champlain to Vergennes.

A channel of the desired depth, but only 40 feet wide, has been secured; the dimensions have, however, probably been diminished on account of shoaling during the time of freshets.

No work was done during the present fiscal year. The funds appropriated by the river and harbor act of March 3, 1899, will be expended in dredging and removal of some loose stone from the channel. A detailed statement of the work done can be found in the Report of the Chief of Engineers for 1897, page 3299.

After the completion of the work, it will probably require an annual expenditure of $1,000 to maintain the improvement.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899....	$1,000.00
July 1, 1899, balance unexpended	1,000.00
Amount (estimated) required for completion of existing project.........	11,248.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—		By act of—	
June 10, 1872	$10,000	September 19, 1890	$5,000
March 3, 1875................	5,000	July 13, 1892	10,000
June 18, 1878	8,000	August 18, 1894..............	5,000
March 3, 1879................	5,000	June 3, 1896	5,000
June 14, 1880	2,000	March 3, 1899................	1,000
March 3, 1881................	2,000		
August 2, 1882................	2,000	Total	62,500
August 11, 1888..............	2,500		

COMMERCIAL STATISTICS.

Vessels engaged in trade.

Class.	Number.	Tonnage.	Draft.
			Feet.
Steam	3	13,080	6
Canal boats and barges..................................	35	7,700	6

Freight handled.

Articles.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
Coal..	5,000	5,000	5,000
Lumber..	3,000	2,352	1,080
Iron..	2,300	800	1,050
Kaolin	1,000	450	300
General merchandise	1,375	450	250
Total...	12,675	9,052	7,680

G 3.

IMPROVEMENT OF NARROWS OF LAKE CHAMPLAIN, NEW YORK AND VERMONT.

This improvement consists in widening and deepening the channel from Whitehall, N. Y., the northern terminus of the Champlain Canal, to Bensons Landing, Vt., a distance of 15 miles.

Under various appropriations the depth of the channel has been increased to 12 feet, but at the close of the last fiscal year a shoaling had occurred in places, which restricted the draft which vessels could carry to not exceeding 10 feet.

No work was done during the present fiscal year. The funds appropriated by the river and harbor act of March 3, 1899, will be expended in dredging where necessary and in erecting guide and fender piles.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$5,000.00
July 1, 1899, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	17,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—

August 5, 1886	$30,000
August 11, 1888	15,000
July 13, 1892	18,500
March 3, 1899	5,000
Total	68,500

COMMERCIAL STATISTICS.

Amount of freight passing through the Narrows of Lake Champlain.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Timber and lumber	119,201	93,181	100,806
Pulp, wood	115,599	148,188	125,656
Salt	2,592	2,340	2,375
Sugar and molasses	5,540	2,354	152
Coal	173,576	156,604	159,558
Stone, lime, and clay	11,434	19,414	19,178
Iron ore	82,550	64,767	59,687
General merchandise	32,686	33,030	31,319
Total	543,178	519,878	498,731
Number of boats passing through the Narrows	4,004	3,724	3,485

G 4.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

The portion of this river now under improvement by the United States extends from the State dam at Troy downstream to Coxsackie. The object is to provide navigation with a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. Below this latter point there is ample depth and width of channel.

The Report of the Chief of Engineers for 1885, page 677 et seq., contains a history of this work, accompanied by original reports and two sketches showing its condition at that time.

The report of the Board of Engineers who formulated the present project is contained in the Report of the Chief of Engineers for 1892, page 750 et seq.

Other information in regard to this improvement, including a tabulated statement of the condition of the channel on June 30, 1898, is contained in the Report of the Chief of Engineers for 1898, page 1052 et seq.

WORK DONE DURING THE PRESENT FISCAL YEAR.

No contracts were in force at the beginning of the present fiscal year.

A contract was entered into with Kirk, Driscoll & Co., of Syracuse, N. Y., on September 16, 1898, for constructing and repairing dikes and for furnishing rubble and paving stone.

Work on this contract began on October 5, 1898, by the delivery of paving stone for the Port Schuyler Dike. The driving of piles for the repair of the New Baltimore and Castleton dikes began on October 25 and November 15, respectively. Rains and consequent high water interfered with the progress of the work, but by working at intervals during the winter, as stages of the water and condition of the ice would permit, enabled waling pieces to be placed and bolted to the piling, so that it was all secured and passed through the break-up in the spring without injury.

Rubblestone for the strengthening and protection of the footing courses of the paved dikes between Van Wies Point and Troy was delivered under the contract and distributed by hired labor.

Pile driving was resumed on April 25, 1899, on the New Baltimore Dike, and was transferred on May 10 to the Willow Island Dike. Pile driving for this latter dike having been completed on June 14, the driver was employed in making repairs to the New Baltimore and Barren Island dikes, which are still in progress. The placing and bolting of the waling timbers of the Willow Island Dike and the filling in of the stone was in progress, but no section had been completed at the close of the year.

A contract was entered into with Kirk, Driscoll & Co., of Syracuse, N. Y., on June 28, for removal of rock and for dredging; but as it had not received the approval of the Chief of Engineers at the close of the year, work had not been commenced.

The progress of the work done during the fiscal year may be summarized as follows:

CONSTRUCTION OF NEW DIKES.

Under contract with Kirk, Driscoll & Co., one new dike is under construction, beginning at a point on the New Baltimore Dike about 3,000 linear feet south of Vivde Hook Light and running in a southwesterly direction for about 400 feet at an angle of about 35° from the direction of that dike to a point about 900 feet from the West Dike, and then parallel to the West Dike for about 800 feet to a point about 400 feet north of the Willow Island Light. This dike is being built on the plan of a full dike, 12 feet wide from out to out of piling, the piling sawed off at mean high-water level, and will be about 1,200 feet long.

REPAIRS OF EXISTING DIKES.

Under contract with Kirk, Driscoll & Co., rubble and paving stone was delivered for repairing dikes as follows:

Overslaugh Dike No. 2.—One hundred and thirty-four cubic yards of rubblestone to strengthen the footing course of the paving on sections aggregating 300 linear feet, at a cost of $119.26.

Overslaugh Dike No. 1.—One hundred and eighteen cubic yards of rubblestone to strengthen the footing course of the paving on sections aggregating 200 linear feet, at a cost of $105.02.

Patroons Lower Island Dike.—Four hundred and eighty-four cubic yards of rubblestone for protection of footing course over a distance aggregating 2,000 linear feet, at a cost of $430.76.

Patroons Island Revetment.—Two hundred and eighty cubic yards of rubblestone for protection of footing course over a distance aggregating 1,800 linear feet, at a cost of $222.50.

Breaker Island Half Dike.—One hundred and fifty-four cubic yards of rubblestone to compensate for settlement of stone in dike over a distance of 925 linear feet, at a cost of $137.06.

Breaker Island Revetment.—Ninety cubic yards of rubblestone for protection of footing course over an aggregate distance of about 300 linear feet, at a cost of $80.10.

Port Schuyler Dike.—One cubic yard of rubblestone and 880 cubic yards of paving stone for the repairs of the paving over an aggregate distance of 1,600 linear feet, at a cost of $1,282.89.

The following quantities of materials for dike construction and repairs have been delivered in place, viz:

Pine piling	linear feet	99,047
Round timber	do	3,047
Square timber	feet B. M.	33,497
Tie rods and screw bolts	pounds	12,088
Driftbolts and washers	do	5,167
Rubblestone	cubic yards	3,341
Quarry spawls	do	435
Paving stone	do	880

HIRED LABOR.

A master laborer and 21 men were employed on repairs of paving of dikes from August 1 to 17, 1898. The number of laborers was increased to 35 by the end of the month, then ranged from 27 to 31 men until November 30, when all but 11 were discharged, and the whole force was discharged December 13, when intensely cold weather prevented any further work.

June 7, 1899, work was resumed on the repairs of paving with a master laborer and 10 laborers, who have been engaged on repairing small sections of the paving of Patroons Lower Island Dike, which showed signs of weakness, and in distributing and laying carefully the rubblestone for the protection of the footing course.

HYDROGRAPHIC WORK.

The hydrographic party was employed making surveys and examinations of the channel between Coxsackie and Troy, N. Y., in making borings for the development of the reefs of rock at Mull's Cross-over and in front of Troy, and in calculations of quantities of dredging and rock to be removed.

Guide piles, to mark the location of dikes near the channel, where submerged during very high tides or in freshets, have been driven at a cost of $83.67.

GENERAL REMARKS.

During the season of navigation of 1898 the water in the river was kept at a freshet stage most of the time, and therefore, though tidal records were kept at three stations, viz, Albany, Green Island, opposite Broadway, Troy, and near the State dam at Troy, the results are not of much value so far as indicating the effect of the opening of the channel upon the range of the tides. The following table of tides above Albany has been compiled from records, eliminating as far as possible the tides affected by rains and storms, the elevations given being above that of similar tides at Governors Island, New York. Reference is made to the Report of the Chief of Engineers for 1897, page 998, for results of tidal observations of previous seasons.

Locality.	Elevation of mean low water.			Elevation of mean high water.			Mean rise and fall of tides.		
	1876.	1897.	1898.	1876.	1897.	1898.	1876.	1897.	1898.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Albany	2.43	2.39	2.50	0.39	0.87	0.96	2.32	2.86	2.84
Nail works, Troy	2.98	2.53	....	0.55	1.04	....	1.95	2.89	....
Broadway, Troy	3.09	2.53	2.70	0.63	1.03	1.12	1.92	2.88	2.80
State dam, Troy	4.53	4.17	4.45	0.95	1.28	1.39	0.80	1.49	1.32

The results for 1898, recorded above, show that they are affected somewhat by the freshets, so that the range of the tide was slightly less at all stations than that observed in 1897, but still indicate a decided improvement as the result of the dredging of a larger channel.

The soundings taken since the opening of navigation have shown that the dredged channel is generally maintaining its depth, but on some of the bars there has been considerable shoaling, due either to local causes, as at Bath Cross-over, or to ice dams, as at Castleton and Stone Light Shoals.

From Castleton to Albany the channel is generally 12 feet deep and more at mean low water, with a width varying from 50 to 150 feet, but the depth of the through channel has been reduced to 10.5 feet at Willow Island Shoal, with a width of about 400 feet, and to 11 feet at Castleton, with a width of 100 feet. At Mull's the depth is practically 12 feet, but the bottom is still shifting and very irregular.

Between Albany and the foot of Broadway, Troy, with the exception of Bath Cross-over, where the depth is only 10.5 feet with a width of

200 feet, and in front of the Watervliet Arsenal, where the depth is 11.5 feet, with a width of 160 feet, there is a through channel of 12 feet depth, ranging in width from 50 to 200 feet.

Between the foot of Broadway, Troy, and the State dam no dredging has yet been done, and the navigable channel is confined to a width of about 50 feet, with a depth of 5.5 feet.

The result of the dredging between Albany and Troy seems to be very satisfactory, for with the exception of Bath Cross-over, where the sudden widening of the surface of the river causes a great decrease in velocity, the dredged channel has maintained its depth and width with very little change during the past two years.

The following table, compiled from the data furnished by the soundings taken since the opening of navigation in the spring of 1899, shows the depth and width of the deepest navigable channel through the bars and shoals, as compared with those of 1898.

Locality.	1898.		1899.	
	Width.	Depth.	Width.	Depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*
Coxsackie Shoal	100	12	....	....
Stone House Bar	50	11.5	200	11.5
Willow Island Shoal	300	11	400	10.5
Mulls Cross-over	100	12	220	11.5
Nine-mile Tree Cross-over	250	11.5	200	12
Castleton Bar	50	11.5	100	11
Cedar Hill Bar	170	11.5	60	12
Winnies Bar	70	11.5	30	11.5
Stone Light Shoal	180	11.5	60	11.5
Beacon Island Shoal	150	12	50	12
Bogart Light Shoal	120	11.5	50	11.5
Douws Point Cross-over	150	12	150	12
Cuyler Bar	100	12	100	12
Through draws of bridges, Albany	100	11.5	110	12
Bath Cross-over	180	11.5	200	10.5
Bath Shoal	140	12	160	12
Kellog Shoal	70	12	140	12
Fishhouse Shoal	250	12	140	12
Round Shoal	130	12	70	12
Covill Folly	180	12	50	12
Opposite Breaker Island	180	12	100	12
Van Buren Bar	190	12	160	12
Washington Bar	200	12	200	12
Opposite Watervliet Arsenal	100	11.5	160	11.5
Arsenal to Congress street, Troy	70	12	200	12
Through draw Congress Street Bridge	100	12	100	12
Congress street to Broadway, Troy	250	11	250	9
Broadway to State dam, Troy	50	5.5	50	5.5

The condition of the dikes built within the past eight years is good, though some of them will require a few hundred cubic yards of rubblestone where the stone filling has settled. The condition of the new paved dikes has improved, but for several years they will require to be watched, and the footings thoroughly protected by rubblestone, and the young trees pulled out before their roots take sufficient hold to upset the paving stone.

Many of the old dikes require extensive repairs even after the present contract is completed, especially Roah Hook dike, Upper Schodack Island half-dike (built in 1869), a section of Castleton dike, Cedar Hill dike, Campbell Island single-pile dike, a section of Winnie's dike, Papscanee dike, Section III and I, Bogart Island dike, Cuyler dike, and sections of Bath dike. The Overslaugh paved dikes have deteriorated very much in the past year, and must receive extensive repairs soon in order to prevent enormous breaks occurring.

This improvement has been under the local charge of Mr. R. H. Talcott, assistant engineer, stationed at Albany.

The appropriation asked for during fiscal year ending June 30, 1901, is to be expended under the continuing contract with Kirk, Driscoll & Co. Of this amount $150,000 is to be applied to rock removal, $150,000 to dredging, $60,000 to construction and repair of dikes, and the balance for contingent expenses of the work.

Money statement.

July 1, 1898, balance unexpended		$201,837.69
Amount appropriated by river and harbor act approved March 3, 1899		100,000.00
		301,837.69
June 30, 1899, amount expended during fiscal year		144,474.14
July 1, 1899, balance unexpended		157,363.55
July 1, 1899, outstanding liabilities	$9,743.93	
July 1, 1899, amount covered by uncompleted contracts	32,996.07	
		42,740.00
July 1, 1899, balance available		114,623.55
Amount (estimated) required for completion of existing project		1,764,567.00
Amount that can be profitably expended in fiscal year ending June 30, 1901		400,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

By act of—	
June 30, 1834	$70,000.00
July 2, 1836	100,000.00
March 3, 1837	100,000.00
July 7, 1838	100,000.00
August 30, 1852	50,000.00
June 26, 1864, allotment	33,000.00
June 23, 1866	50,000.00
March 3, 1867	305,188.00
July 25, 1868, allotment	85,000.00
April 10, 1869, allotment	89,100.00
July 11, 1870	40,000.00
March 3, 1871	40,000.00
June 10, 1872	40,000.00
March 3, 1873	40,000.00
June 23, 1874	40,000.00
March 3, 1875	40,000.00
August 14, 1876	50,000.00
June 18, 1878	70,000.00
March 3, 1879	30,000.00
June 14, 1880	20,000.00

By act of—	
March 3, 1881	$15,000.00
August 2, 1882	10,000.00
July 5, 1884	30,000.00
August 5, 1886	26,250.00
August 11, 1888	75,000.00
September 19, 1890	150,000.00
July 13, 1892	187,500.00
March 3, 1893	500,000.00
August 18, 1894	145,000.00
March 3, 1895	500,000.00
June 11, 1896	480,000.00
June 4, 1897	475,000.00
July 1, 1898	160,406.56
March 3, 1899	100,000.00
Total	4,246,444.56
Received from other sources	792.57
Total	4,247,237.13

Abstract of proposals for constructing and repairing dikes in Hudson River, New York, received in response to advertisement dated August 8, 1898, and opened by Co.l J. W. Barlow, Corps of Engineers, at New York City on September 8, 1898.

No.	Name and address of bidder.	Pine or spruce piles, 103,000 linear feet.	Round timber, 11,000 linear feet.	Square timber, yellow pine, 306,000 feet.	Tie rods and screw bolts, 136,000 pounds.	Drift bolts, etc., 43,000 pounds.
1	International Contracting Co., 95 Broad street, New York	$0.12½	$0.12½	$35.00	$0.04	$0.04
2	James Du Bois & Co., 11 Broadway, New York	.11	.11	27.25	.04½	.04¾
3	Chas. W. Johnston, Lewes, Del	.13	.13	18.50	.06	.06
4	Frank Pidgeon, Saugerties, N. Y	.11½	.15	36.00	.03½	.03½
5	P. Sanford Ross, 277 Washington street, Jersey City	.12¾	.10	35.00	.03½	.03½
6	John Berkery, 11-13 William street, New York	.10	.08	27.50	.05	.05
7	William Parrott, Newburg, N. Y	.10⅞	.10	38 50	.04	.04
8	Richard Parrott, Newburg, N. Y	.11½	.11½	35.00	.04	.03½
9	A. F. Chapman & Co., 476 Ellicott Square Building, Buffalo	.109	.10¾	33.00	.03¾	.04
10	John E. Pidgeon, Manlius Center, N. Y	.10	.09	33.00	.03½	.03½
11	Kirk, Driscoll & Co., 10 Dunfee Building, Syracuse	.11	.09	35.00	.03¾	.03½
12	Wm. D. Fuller, New Baltimore, N. Y	.10¾	.10	36.00	.04	.04

No.	Name and address of bidder.	Rubblestone put in dike, 11,200 cubic yards.	Quarry spalls put in dike, 2,000 cubic yards.	Rubblestone, delivered, 1,100 cubic yards.	Paving stone, delivered, 1,000 cubic yards.	Total.
1	International Contracting Co., 95 Broad street, New York	$0.90	$0.75	$0.90	$1.25	$53,690.00
2	James Du Bois & Co., 11 Broadway, New York	.95	.95	.95	1.40	51,541.00
3	Chas. W. Johnston, Lewes, Del	.95	.90	.95	.98	55,536.00
4	Frank Pidgeon, Saugerties, N. Y	.95	1.25	.95	1.25	52,513.50
5	P. Sanford Ross, 277 Washington street, Jersey City	1.00	.90	1.00	1.75	55,032.50
6	John Berkery, 11-13 William street, New York	1.00	1.00	1.00	1.25	50,345.00
7	William Parrott, Newburg, N. Y	.90	.90	.90	1.50	51,549.75
8	Richard Parrott, Newburg, N. Y	.85	1.00	1.00	1.50	51,735.00
9	A. F. Chapman & Co., 476 Ellicott Square Building, Buffalo	.90	.79	.98	1.75	49,855.00
10	John E. Pidgeon, Manlius Center, N. Y	1.25	1.10	1.25	1.40	52,328.00
11	Kirk, Driscoll & Co., 10 Dunfee Building, Syracuse	.89	.70	.89	1.40	49,782.00
12	Wm. D. Fuller, New Baltimore, N. Y	.87	.75	.94	1.89	50,591.50

Abstract of proposals for removal of rock and for dredging in Hudson River, New York, received in response to advertisement dated May 22 and opened June 22, 1899, by Col. J. W. Barlow, Corps of Engineers, at New York City.

No.	Name and address of bidder.	30,000 cubic yards of rock removal.	400,000 cubic yards dredging south of north end of High Dike.	500,000 cubic yards dredging north of north end of High Dike.	Total.
		Cu. yards.	*Cu. yards.*	*Cu. yards.*	
1	Kirk, Driscoll & Co., Syracuse, N. Y	$4.75	$0.19	$0.24½	$341,000
2	R. G. Packard Co., New York, N. Y	7.00	.23½	.31	459,000
4	E. C. Moore, New York, N. Y	5.20	.23$\frac{7}{10}$	.30$\frac{7}{10}$	404,300
4	Peter W. Myers & Son, Albany, N. Y	....	....	.19	....
5	International Contracting Co., Syracuse, N. Y., and P. Sanford Ross, Incorporated, Jersey City, N. J	4.90	.20½	.25½	354,250

CONTRACT IN FORCE.

Contract with Kirk, Driscoll & Co., of Syracuse, N. Y., dated September 16, 1898, for constructing and repairing dikes and for furnishing rubble and paving stone, work to commence on or before September 20, 1898, and to be completed by December 31, 1899. Approved by Chief of Engineers on September 26, 1898.

COMMERCIAL STATISTICS.

The importance of the Hudson as a great waterway of commerce is apparent when it is known that aside from its own local traffic, which in itself is very large, it absorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburg, and the Erie coal trade at Piermont.

The two principal industries on the river are ice and brick.

Amount of local commerce within limits of improvement.

Articles.	1897.	1898.
	Tons.	*Tons.*
General merchandise	809,746	697,554
Grain, flour, feed, etc	944,806	787,978
Lumber and timber	361,740	565,538
Fuel	479,372	418,741
Building material	388,095	428,245
Ice	699,105	1,197,839
Total	3,682,864	4,045,895

Number of passengers carried in 1898, 771,196.

In addition to this local commerce through commerce amounting to more than 10,000,000 tons annually is carried down the river.

G 5.

IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.

The improvement of this harbor began in 1887 and by June 30, 1892, it had been completed, at a cost of $42,000. Two dikes were constructed, the length of the north one being 2,058 feet and of the south one 2,363.5 feet. The depth in the channel was increased to 8 feet at mean low tide. Since 1892 the expenditures have been applied to maintenance. A history of the improvement can be found in the Report of the Chief of Engineers for 1895, page 910.

No work was done during the year beyond making a survey of the harbor. This survey indicates that the dikes have been able to maintain a channel of the desired dimensions. The dikes were found to be in fair condition, but the superstructure has commenced to decay and will require renewal in a few years.

The cost of maintaining this work is estimated at $2,500 annually.

Money statement.

July 1, 1898, balance unexpended	$332.59
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	2,832.59
June 30, 1899, amount expended during fiscal year	149.49
July 1, 1899, balance unexpended	2,683.10
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Appropriations.

By act of—		By act of—	
July 5, 1884	$5,000	August 18, 1894	$5,000
August 5, 1886	15,000	June 3, 1896	2,500
August 11, 1888	12,000	March 3, 1899	2,500
September 19, 1890	10,000		
July 13, 1892	5,000	Total	57,000

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Tonnage.	Draft.
			Feet.
Steam	5	2,000	7
Canal	16	1,800	7 to 11

Passengers carried, 20,000.

Freight handled.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Bluestone	100,000	40,000	40,000
Coal	10,000	5,000	11,000
Building material	2,500	1,000	1,650
General merchandise	7,800	5,000	5,718
Total	120,300	51,000	58,368

G 6.

IMPROVEMENT OF HARBOR AT RONDOUT, NEW YORK.

The improvement of this harbor consists in widening and deepening Rondout Creek by means of dikes and dredging. Work began in 1872 and was completed in 1880, at a cost of $90,000, a channel depth of 14 feet having been secured. Since 1880 the expenditures have been applied to maintenance. A history of the work is printed in the Report of the Chief of Engineers for 1895, page 913.

No work was done during the present fiscal year, no complaints having been received as to insufficient depth in the channel. Steps were taken to have a survey made of the harbor in order to determine what work should be done during the coming year.

It is estimated that an average annual appropriation of $2,500 will be sufficient to maintain this improvement.

Money statement.

July 1, 1898, balance unexpended	$4,684.24
June 30, 1899, amount expended during fiscal year	8.44
July 1, 1899, balance unexpended	4,675.80
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—	
June 12, 1872	$10,000
March 3, 1873	20,000
June 8, 1875, allotment	1,000
August 14, 1876	30,000
June 15, 1878	30,000
August 2, 1882	2,000
July 5, 1884	1,000
August 5, 1886	2,500
August 11, 1888	$5,000
September 19, 1890	5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,500
Total	119,000

COMMERCIAL STATISTICS.

Freight handled.

Articles.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
General merchandise	667,000	900,000	900,009
Coal	400,000	380,250	385,000
Brick	286,000	290,000	280,000
Building stone	200,000	210,300	215,000
Cement, lime, and sand	517,500	512,500	510,000
Ice		40,000	40,000
Total	2,070,500	2,333,050	2,330,000

Regular lines of steamers carry over 150,000 passengers annually.

The character and number of vessels employed in trade could not be procured.

No commercial statistics were furnished for the year 1898, although efforts were made to procure them.

G 7.

IMPROVEMENT OF HARBOR AT PEEKSKILL, NEW YORK.

This improvement has for its object the excavation and maintenance of a 10-foot channel, 100 feet wide, from the deep water in the Hudson River on the north to the upper wharf at Peekskill, thence along the wharf front to the lower wharf, and thence to deep water in the Hudson River on the south.

A description of the locality and a history of the work done is given in the Report of the Chief of Engineers for 1897, page 1016.

No work was done during the present year except to make a partial survey of the harbor. It was expected that dredging would have been commenced before the close of the year under contract entered into May 18 with John P. Randerson, of Albany, N. Y., but this was prevented by an accident which happened to the contractor's plant.

Money statement.

July 1, 1898, balance unexpended	$199.43
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	10,199.43
June 30, 1899, amount expended during fiscal year	322.17
July 1, 1899, balance unexpended	9,877.26
July 1, 1899, amount covered by uncompleted contracts	9,350.00
July 1, 1899, balance available	527.26
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—

June 3, 1896	$10,000
March 3, 1899	10,000
Total	20,000

Abstract of proposals for dredging in Peekskill Harbor, New York, received in response to advertisement dated April 8, 1899, and opened by Col. J. W. Barlow, Corps of Engineers, at New York City, on May 8, 1899.

No.	Name and address of bidder.	Price bid per cubic yard.	Amount of material that can be dredged with the available funds, $9,600, at prices bid.
		Cents.	*Cubic yards.*
1	Atlantic Dredging Co., 31-33 Pine street, New York City	13½	71,110
2	John P. Randerson, 62 Quay street, Albany, N. Y	8½	112,940
3	P. J. Brummelkamp, Syracuse, N. Y	11	87,270
4	The Newburg Dredging Co., Newburg, N. Y	9	106,660
5	Edgar M. Payn, Albany, N. Y	12$\frac{7}{10}$	75,590
6	John H. Fenner, 1 Montgomery street, Jersey City, N. J	14¾	65,085

CONTRACT IN FORCE.

Contract with John P. Randerson, of Albany, N. Y., dated May 18, 1899, for dredging, work to commence on or before June 15, and to be completed by August 31, 1899, approved by the Chief of Engineers on June 5, 1899.

COMMERCIAL STATISTICS.

Freight handled.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
General merchandise	150,200	151,300	376,350
Building material	36,500	40,500	42,300
Iron ore and manufactured articles	69,300	60,000	94,000
Coal and wood	16,500	58,000	119,300
Lumber	48,500	44,500	83,000
Molding sand	225,000	50,000	20,000
Total	546,000	404,300	734,950

Ten steamboats, 2 freight boats, and 910 sailing vessels and other craft were engaged in carrying above freight.

G 8.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

A description of this locality and the history of the work which has been done are printed in the Report of the Chief of Engineers for 1897, pages 1128 and 1129.

No work was done during the present fiscal year, but preparations were being made to resume operations as soon as detailed information can be obtained and specifications prepared and the work advertised.

A channel of the proposed width has been dredged all the way to Passaic except at Rutherford Park Bar; it has, however, deteriorated more or less since operations have been suspended. After completion of this work an annual appropriation will be required for maintenance.

Money statement.

July 1, 1898, balance unexpended	$37.81
Amount appropriated by river and harbor act approved March 3, 1899	15,000.00
	15,037.81
June 30, 1899, amount expended during fiscal year	96.14
July 1, 1899, balance unexpended	14,941.67
Amount (estimated) required for completion of existing project	79,347.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—		By act of—	
June 10, 1872	$25,000	July 5, 1884	$28,000
March 3, 1873	25,000	August 5, 1886	26,250
June 23, 1874	20,000	August 11, 1888	35,000
March 3, 1875	20,000	September 19, 1890	45,100
August 10, 1876	10,000	July 13, 1892	45,000
June 18, 1878	10,000	August 18, 1894	15,000
March 3, 1879	2,000	June 3, 1896	15,000
June 14, 1880	32,000	March 3, 1899	15,000
March 3, 1881	50,000		
August 2, 1882	50,000	Total	468,350

COMMERCIAL STATISTICS.

Freight handled and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Building materials	297,725	409,017	470,368
Ores and metals	124,725	96,167	120,908
Fertilizers	94,191	72,612	72,093
Coal	96,490	113,406	124,746
Miscellaneous merchandise	316,247	318,152	349,967
To and from Hackensack River	314,235	361,370	371,690
Total	1,243,613	1,370,724	1,509,772

A statement of the number, character, and tonnage of the vessels engaged in this trade could not be obtained.

The total number of vessels registered on December 31, 1898, at the United States Custom-House, Newark, N. J., on the Passaic River was 76; total registered tonnage, 8,164; total number of vessels entered and cleared during the year 1898, 102; with a tonnage of 25,099 tons.

G 9.

IMPROVEMENT OF CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

A description of this waterway and a history of the work done are printed in the Annual Report of the Chief of Engineers for 1897, pages 1130 to 1132.

No work was done during the present fiscal year. A survey will be made for the purpose of determining where dredging is urgently needed, after which specifications will be prepared and the work advertised.

At the close of the last fiscal year the channel had a depth of 14 feet, mean low water, and a least width of 200 feet. It practically retains its full depth at the present time. The width, however, has been reduced, owing to washing in of material from the adjacent flats.

This improvement, after its completion, will require an annual expenditure for maintenance.

Money statement.

July 1, 1898, balance unexpended	[1]$1,092.77
Amount appropriated by river and harbor act approved March 3, 1899	32,000.00
	33,092.77
June 30, 1899, amount expended during fiscal year	100.00
July 1, 1899, balance unexpended	32,992.77
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	10,000.00

Appropriations.

By act of—	
June 23, 1874	$50,000
August 14, 1876	10,000
June 18, 1878	15,000
June 14, 1880	29,000
August 2, 1882	40,000
July 5, 1884	10,000
August 5, 1886	15,000
August 11, 1888	[2]25,000
September 19, 1890	[2]$22,000
July 13, 1892	20,000
August 18, 1894	[1]10,500
June 3, 1896	[3]13,000
March 3, 1899	32,000
Total	291,500

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[1] Unexpended balance from appropriation for improvement Arthur Kill, New York and New Jersey.

[2] Includes appropriations made for improving Arthur Kill, New York and New Jersey.

[3] Includes $5,000 for Lemon Creek.

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1806.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal and ores	6,960,412	....	7,404,164
Clay products	762,774	....	914,553
Chemicals and fertilizers	176,075	....	244,135
Oils	366,360	....	63,043
Grain	477,500	....	877,659
Machinery and manufactures	....	....	258,296
General merchandise	509,982	....	422,411
Total	9,253,103	10,500,832	10,184,261

The commerce for the year 1898 was valued at $143,640,800.

The valuation of ores only was over $30,000,000.

In addition to the above figures the tonnage of vessels brought to shipyards along the waterway hauled out and repaired during the year 1898 is estimated at 500,000 tons and valued at $10,000,000.

The freights are carried in barges, canal boats, steam and sail vessels, drawing from 5 to 23 feet of water.

G 10.

IMPROVEMENT OF ELIZABETH RIVER, NEW JERSEY.

A history of this work and a description of the locality are given in the Report of the Chief of Engineers for 1897, pages 1134 and 1135.

No work was done during the present year, no funds being available for that purpose.

When work was last suspended a channel of the desired depth and from 30 to 60 feet wide had been secured from the mouth to Bridge street, Elizabeth. As this channel is not able to maintain itself it has probably deteriorated some. To maintain the required channel an annual appropriation of $2,500 is considered necessary.

Money statement.

Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	$2,500.00

Appropriations.

By act of—		By act of—	
March 3, 1879	$7,500	July 13, 1892	$5,000
June 14, 1880	7,500	August 18, 1894	3,000
March 3, 1881	4,000	June 3, 1896	3,160
August 2, 1882	8,000		
September 19, 1890	5,000	Total	43,160

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
Coal	13,300	18,000	14,270
Lumber	....	6,700	3,000
Building material	8,000	8,650	8,750
Miscellaneous	350	2,716	2,845
Total	21,650	36,066	28,865

A statement of the number, character, tonnage, etc., of the vessels employed in this trade could not be procured.

G II.

IMPROVEMENT OF RARITAN RIVER, NEW JERSEY.

A description of this river and a history of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1136 and 1137.

No work was done during the fiscal year, as no funds were available while navigation was suspended, during which period the proposed operations are to be carried on.

Specifications will be prepared and the work advertised, so that operations may be commenced as soon as navigation closes in December.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$20,000.00
July 1, 1899, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	1,422,412.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—		By act of—	
June 18, 1878	$200,000	September 19, 1890	$50,000
March 3, 1879	60,000	July 13, 1892	40,000
June 14, 1880	100,000	August 18, 1894	20,000
March 3, 1881	25,000	June 3, 1896	20,000
August 2, 1882	25,000	March 3, 1899	20,000
July 5, 1884	35,000		
August 5, 1886	26,250	Total	671,250
August 11, 1888	50,000		

In addition to the above, $13,963 was appropriated for improving New Brunswick Harbor, New Jersey, in 1836–37.

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal, clay, ores, etc	400, 301	311, 046	350, 790
Manufactures, mainly brick	489, 683	652, 922	658, 986
Lumber	....	40, 428	38, 279
Miscellaneous	246, 990	214, 356	212, 917
Total	1, 136, 974	1, 218, 752	1, 255, 972

The commerce of 1898 was valued at $29,301,474, and was carried in barges, canal boats, steam and sail vessels drawing from 5 feet to 17 feet of water. The total of all trips reported was 20,501, including 6,967 trips by tugs and excursion steamers.

G 12.

IMPROVEMENT OF SOUTH RIVER, NEW JERSEY.

A description of this stream and a history of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1139 and 1140.

No work was done during the fiscal year except to make an examination of the river and prepare specifications for continuing the work, which will be resumed at an early date.

A depth of 7 feet can be carried over the shoalest part of the improvement at mean low water to the town of South River; above the town a depth of 5 feet can be carried to the railroad bridge.

Money statement.

July 1, 1898, balance unexpended	$522. 15
Amount appropriated by river and harbor act approved March 3, 1899	5, 000. 00
	5, 522. 15
June 30, 1899, amount expended during fiscal year	23. 30
July 1, 1899, balance unexpended	5, 498. 85
Amount (estimated) required for completion of existing project	83, 975. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—		
March 3, 1871	$15, 000	
March 3, 1873	5, 000	
		$20, 000
June 14, 1880	40, 000	
March 3, 1881	6, 000	
August 2, 1882	10, 000	
August 5, 1886	5, 000	
August 11, 1888	5, 000	
September 19, 1890	5, 000	
July 13, 1892	7, 000	
August 18, 1894	5, 000	
June 3, 1896	5, 000	
March 3, 1899	5, 000	
		93, 000
Total		113, 000

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal, clay, ore, etc	70,738	64,916	60,035
Manufactures, brick, etc	145,570	243,185	209,684
Miscellaneous	475	462	4,662
Total	216,783	308,563	274,381

The commerce for 1898 was valued at $1,405,816 and was carried in barges, canal boats, steam and sail vessels, drawing from 5 feet to 12 feet of water. The total number of trips by vessels of all classes was 3,046.

G 13.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

For a history of this work and a description of the locality, see Report of the Chief of Engineers for 1897, pages 1142 and 1143.

The only work done during the present year was the making of a survey of the bay in the vicinity of South Amboy and Seguine Point for the purpose of ascertaining the condition of the dredged channels, so as to decide where the available funds should be expended.

The work at Seguine Point is not of a permanent character. The South Amboy Channel has been dredged and redredged to a depth of 21 feet, with widths varying from 100 to 300 feet. As soon as operations have been suspended the action of the cross currents again shoals the dredged channels on the sides and to some extent in the center. It will require an annual expenditure for maintenance upon the completion of the work.

Money statement.

July 1, 1898, balance unexpended	$3,153.64
Amount appropriated by river and harbor act approved March 3, 1899	65,000.00
	68,153.64
June 30, 1899, amount expended during fiscal year	903.64
July 1, 1899, balance unexpended	67,250.00
Amount (estimated) required for completion of existing project	65,375.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	65,375.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—		By act of—	
March 3, 1881	$50,000	July 13, 1892	$40,000
August 2, 1882	50,000	August 18, 1894	40,000
July 5, 1884	20,000	June 3, 1896	75,000
August 5, 1886	37,500	March 3, 1899	65,000
August 11, 1888	25,000		
September 19, 1890	40,000	Total	442,500

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal, ores, etc	3,619,165	3,605,514	4,293,827
Lumber	33,898	....	33,279
Building material	....	45,368	....
Fertilizers	....	84,521	131,162
Manufactures	542,783	671,795	900,363
Merchandise	433,668	444,877	193,843
Total	4,629,514	4,852,075	5,562,474

About 75 per cent of the commerce of 1898 passed through the South Amboy Channel, 40 per cent passed through the Seguine Point Channel, and 15 per cent through both channels. The total commerce of 1898 was valued at $47,576,353 and was carried in barges, canal boats, steam and sail vessels, drawing from 5 to 23 feet of water. The total number of trips of vessels passing through the South Amboy Channel was reported as 55,501, including 6,967 trips by tugs and excursion steamers.

The total number of vessels registered at the United States customhouse at Perth Amboy, N. J., on December 31, 1898, was 410, and the gross tonnage, 56,250. During the year 1898 the entries and clearances from and for foreign ports numbered 84, with a net tonnage of 23,384 tons; the entries and clearances in coastwise traffic numbered 232, net tonnage, 86,527 tons.

G 14.

IMPROVEMENT OF MATAWAN CREEK, NEW JERSEY.

A detailed description of this locality and of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1145 and 1146.

No work was done during the present fiscal year. Proposals for dredging were advertised for and a contract was made with William H. Taylor, jr., of Jersey City, N. J., but it had not received the approval of the Department at the close of the year. Dredging will be commenced as soon as the contract has been returned approved.

Although more than the estimated cost of this work has been appropriated and expended it has not been completed, owing to the necessity of redredging portions of the channel which had shoaled when operations were suspended. To maintain a channel of the desired dimensions it is estimated that it will require an annual sum of $3,000.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$3,000.00
June 30, 1899, amount expended during fiscal year	34.79
July 1, 1899, balance unexpended	2,965.21
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	3,000.00

Appropriations.

By act of—		By act of—	
March 3, 1881	$15,000	June 3, 1896	$3,000
August 2, 1882	6,000	March 3, 1899	3,000
September 19, 1890	2,500		
July 13, 1892	9,620	Total	42,120
August 18, 1894	3,000		

Abstract of proposals for dredging in Matawan Creek, New Jersey, received in response to advertisement dated May 3, 1899, and opened June 3, 1899, by Col. J. W. Barlow, Corps of Engineers.

[Amount to be expended, $2,700.]

No.	Name and address of bidder.	Price per cubic yard, scow measurement.
		Cents.
3	James McSpirit & Sons, Jersey City, N. J	29
4	William H. Taylor, jr., Jersey City, N. J	26

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
Grain	....	30,000	30,000
Lumber	225	5,000	5,000
Brick and building material	200,000	25,000	5,000
Farm produce, merchandise, etc	137,800	375,000	375,000
Total	338,025	435,000	415,000

A statement of the number, character, tonnage, etc., of the vessels employed in this trade could not be procured.

No commercial statistics were furnished for the year 1898, although efforts were made to procure them.

G 15.

IMPROVEMENT OF HARBOR AT KEYPORT, NEW JERSEY.

A description of this locality and a history of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1147 to 1149.

No work was done during the present fiscal year. Proposals for dredging were advertised for and a contract was made with William H. Taylor, jr., of Jersey City, N. J., but it had not received the approval of the Department at the close of the year. Dredging will be commenced as soon as contract has been returned approved.

This work is not of a permanent character. More than the amount of the estimate has been appropriated and expended on this work, and still the channel has not reached the desired dimensions. This is due to shoaling, which occurs when work is suspended. It is estimated that a channel of the desired dimensions can be maintained with an average annual expenditure of $5,000.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$2,500.00
June 30, 1899, amount expended during fiscal year........................	24.75
July 1, 1899, balance unexpended	2,475.25
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement..	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—

August 2, 1882	$30,475
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896..	2,500
March 3, 1899	2,500
Total..	45,475

Abstract of proposals for dredging in Keyport Harbor, New Jersey, received in response to advertisement dated May 3, 1899, and opened June 3, 1899, by Col. J. W. Barlow, Corps of Engineers.

[Amount to be expended, $2,250.]

No.	Name and address of bidder.	Price per cubic yard, scow measurement.
		Cents.
2	James McSpirit & Sons, Jersey City, N. J	16⅞
4	William H. Taylor, jr., Jersey City, N. J	15⅛

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
Farm produce..	156,700	60,700	63,700
Fertilizers	39,000	8,000	8,000
Coal and lumber	7,225	8,500	8,500
Fish and shellfish	....	10,000	10,000
Miscellaneous	....	18,000	18,900
To and from Matawan Creek..	231,700	435,000	415,000
Total..	434,625	540,200	524,100

A statement of the number, character, tonnage, etc., of the vessels engaged in this trade could not be procured.

No commercial statistics were furnished for the year 1898, although efforts were made to procure them.

G 16.

IMPROVEMENT OF SHOAL HARBOR AND COMPTON CREEK, NEW JERSEY.

A description of this locality and a history of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1150 and 1151.

No work was done during the present fiscal year. A contract for dredging was, however, entered into and forwarded to the Department for approval. Dredging will commence as soon after approval of contract as the interests of navigation will permit.

A channel 4 feet deep and 75 feet wide had been dredged from deep water in Compton Creek to the 2-foot contour in Raritan Bay at the close of the previous fiscal year. It is probable, however, that it has shoaled since then. In order to maintain this work after completion it will require an annual or biennial expenditure.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$8,000.00
June 30, 1899, amount expended during fiscal year	87.52
July 1, 1899, balance unexpended	7,912.48
Amount (estimated) required for completion of existing project	40,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

By act of—	
September 19, 1890	$5,000
July 13, 1892	3,000
August 18, 1894	3,000
June 3, 1896	5,000
March 3, 1899	8,000
Total	24,000

Abstract of proposals for dredging in Shoal Harbor and Compton Creek, New Jersey, received in response to advertisement dated May 3, 1899, and opened June 3, 1899, by Col. J. W. Barlow, Corps of Engineers.

[Amount to be expended, $7,450.]

No.	Name and address of bidder.	Price per cubic yard.	
		Scow measurement.	Prism measurement.
		Cents.	*Cents.*
3	Edgar M. Payn, Albany, N. Y	65	....
5	Alonzo E. Smith, Islip, N. Y	65	....
6	International Contracting Co., New York, N. Y	45	....
7	R. G. Packard Co., New York, N. Y	....	50

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Farm produce	60,000	70,000	75,000
Fish and shellfish	70,000	75,000	75,000
Coal	4,000	4,000	4,500
Fertilizers	25,000	25,000	30,000
Miscellaneous	8,000	10,000	10,000
Total	167,000	184,000	194,500

The above freight was carried by 1 steamer, 1 tug, and 200 sailboats, drawing from 2 to 5 feet of water, and whose tonnage vary from 10 to 420 tons.

G 17.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

A description of this locality and a history of the work done are printed in the Report of the Chief of Engineers for 1897, pages 1152 to 1155.

No work was done during the present year except to make a survey of the river below Highlands Bridge.

Proposals were invited for redredging the channel east of Island Beach and a contract was made and forwarded to the Department for approval, but it had not been returned at the close of the fiscal year.

To secure channels from 100 to 150 feet in width and 6 feet deep in the main stem and branches it will require an average annual expenditure of $10,000 for maintenance.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$10,000.00
June 30, 1899, amount expended during fiscal year	299.85
July 1, 1899, balance unexpended	9,700.15
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

By act of—

August 30, 1852	$1,500	
March 3, 1871	14,000	
March 3, 1873	5,000	
		$20,500
June 18, 1878	18,000	
March 3, 1879	10,000	
June 14, 1880	30,000	
March 3, 1881	86,000	
August 2, 1882	30,000	
August 5, 1886	10,000	
August 11, 1888	10,000	

Appropriations—Continued.

By act of—		
September 19, 1890	$10,000	
July 13, 1892	10,000	
August 18, 1894	5,000	
June 3, 1896	15,000	
March 3, 1899	10,000	
		$244,000
Total		264,500

Abstract of proposals for dredging in Shrewsbury River, New Jersey, received in response to advertisement dated May 3, 1899, and opened June 3, 1899, by Col. J. W. Barlow, Corps of Engineers.

[Amount to be expended, $8,500.]

No.	Name and address of bidder.	Price per cubic yard.	
		Scow measurement.	Prism measurement.
		Cents.	*Cents.*
1	Newburg Dredging Co., Newburg, N. Y	31	
3	Edgar M. Payn, Albany, N. Y	61	
5	Alonzo E. Smith, Islip, N. Y	35	
6	International Contracting Co., New York, N. Y		85
7	R. G. Packard Co., New York, N. Y		27½

COMMERCIAL STATISTICS.

Freight received and shipped by water.

Articles.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Farm produce	290,000	300,000	350,000
Fish and shellfish	11,520	12,000	13,000
Coal	19,620	25,250	30,000
Lumber	800	1,850	1,500
Building material	7,090	8,000	8,500
Miscellaneous	589,600	550,000	600,000
Total	868,130	896,600	1,003,000

Passengers carried, 450,000.

The commerce given for 1898 was carried in 6 steamers and 12 sailing vessels, drawing from 3½ to 5 feet, and whose tonnage varied from 2,000 to 250 tons.

G 18.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

A history of this improvement and map of the locality may be found in the Report of the Chief of Engineers for 1898, pages 1070 and 1071.

Nothing was done during the year except to prepare specifications for the construction and repair of dikes. The work was advertised on June 12, proposals to be opened July 12, 1899.

Money statement.

July 1, 1898, balance unexpended	$1,700.00
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	6,700.00
June 30, 1899, amount expended during fiscal year	38.20
July 1, 1899, balance unexpended	6,661.80
Amount (estimated) required for completion of existing project	13,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act of—	
March 3, 1879	$12,000
June 14, 1880	20,000
August 2, 1882	7,000
September 19, 1890	2,000
March 3, 1899	5,000
Total	46,000

COMMERCIAL STATISTICS.

The commerce of this river amounts practically to nothing, owing to obstructions at the inlet. The river is largely used by pleasure craft during the summer season.

G 19.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

1. *Wreck of canal boat Hazelton in Raritan River, New Jersey.*—This canal boat drifted around Raritan Bay full of water and finally sank alongside of the New York and Long Branch Railroad Company's bridge across Raritan River, New Jersey. The obstruction was reported March 6, and its removal authorized by Department letter of March 16, 1899.

Proposals for removing the wreck were invited by public notice of March 6, the award being made to the lowest bidder, J. H. Gregory, of Perth Amboy, N. J., at a cost of $123.

The removal of the wreck was completed March 25, 1899. Nothing of value was recovered from it.

2. *Wrecks of tug W. R. Sheffield and canal boat McDonald in Hudson River, near Albany, N. Y.*—The explosion of the boiler on the tug *W. R. Sheffield* caused that boat to sink, also the canal boat *McDonald*, which was being towed. A stone barge loaded with stone struck these wrecks soon afterwards, causing it to leak and roll, which resulted in the deck load of stone being dumped into the channel of the Hudson off Bogart Island.

The wrecks were reported on May 18 and their removal was authorized by Department letter of May 20, 1899, immediate steps to be taken to effect the removal of the wrecks, on the best terms obtainable in open market.

Arrangements were accordingly made with Messrs. Berry & Fawls, of Bath-on-the-Hudson, N. Y., to remove the wrecks for the sum of $218, and with the Baxter Wrecking Company, of New York City, to remove the stone for the sum of $925.

The removal of the wrecks was completed on June 3, and of the building stone on June 15, 1899.

The stone removed was disposed of for the sum of $471.75.

3. Wreck of steamboat W. M. Whitney in Hudson River, New York.—This wreck consisted of the hull of the steamboat *W. M. Whitney*, from which all the machinery and upper works had been removed. It was originally intended to convert the hull into a barge, but before this could be done it caught fire and sank at New Baltimore.

The wreck was reported on June 19, and its removal was authorized by Department letter of June 21, 1899.

Proposals have been invited by public notice for removing this wreck.

APPENDIX H.

IMPROVEMENT OF DELAWARE RIVER AND BAY AND OF CERTAIN WATERS TRIBUTARY THERETO, NEW JERSEY, PENNSYLVANIA, AND DELAWARE, AND OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY.

REPORT OF LIEUT. COL. C. W. RAYMOND, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Delaware River, New Jersey and Pennsylvania.
2. Harbor between Philadelphia, Pennsylvania, and Camden, New Jersey.
3. Schuylkill River, Pennsylvania.
4. Ice Harbor at Marcus Hook, Pennsylvania.
5. Construction of iron pier in Delaware Bay, near Lewes, Delaware.
6. Delaware Breakwater, Delaware.
7. Construction of Harbor of Refuge, Delaware Bay, Delaware.
8. Rancocas River, New Jersey.
9. Alloway Creek, New Jersey.
10. Cooper Creek, New Jersey.
11. Mantua Creek, New Jersey.
12. Goshen Creek, New Jersey.
13. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 19, 1899.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 877; 1897, page 1192, and 1898, page 1075.

Expenditures during the past fiscal year have been applied to the following operations:

1. Examinations at Perriwig Bar, Kinkora Bar, Kinkora Bar Dike, Five-Mile Bar, Mifflin Bar, and Bulkhead Bar.

2. Surveys of the channel from Bristol to Burlington, of the rock in the channel opposite Petty Island, and of the channel at Greenwich Point, and below Schooner Ledge.
3. Improvement and survey of Holly Oak Beach.
4. Improvement and survey of Cherry Island Flats.
5. Improvement and survey of shoal below Christiana River.
6. Improvement and survey of shoal between Pennsville and Bulkhead Bar Dike.
7. Repairing Bulkhead Bar Dike.
8. Improvement and survey of Dan Baker Shoal and Duck Creek Flats, including improvement of shoal between deep water above Dan Baker Shoal and deep water below Pea Patch Island (off Salem Cove).

These operations will be described in the above order. The localities referred to and previous operations thereat are described in the Annual Report of the Chief of Engineers for 1896, pages 880–885; 1897, pages 1192–1194, and 1898, pages 1076–1079.

1. EXAMINATIONS.

Perriwig Bar.—A recent examination shows that the channel through this bar has a minimum depth of 6 feet at mean low water.

Kinkora Bar.—A recent examination shows that the channel through this bar has a minimum depth of 8½ feet at low water.

Kinkora Bar Dike.—The examination was made to determine the extent and cost of repairs to the dike which may be made during the present season with funds now available.

Five Mile Bar.—A recent examination shows that the channel through this bar has a depth of 26 feet at mean low water over its whole width. This bar was dredged in connection with the improvement of Philadelphia Harbor.

Mifflin Bar.—A recent examination shows that the channel through this bar has a minimum depth of 26 feet at mean low water. This bar was dredged in 1898 and 1899 by the city of Philadelphia.

Bulkhead Bar.—A recent examination shows that the channel through this bar has a minimum depth of 26 feet at mean low water.

2. SURVEYS.

From Bristol to Burlington.—The survey was made to determine the present condition of the shoal on the Pennsylvania side of the channel between Bristol and Burlington, and the extent of the shoal projecting into the river at the foot of Burlington Island.

Rock in the channel opposite Petty Island.—The survey was made to determine the extent and volume of this rock with a view to its removal to a depth of 26 feet below mean low water. A project for the work was submitted on June 6, 1899, and approved June 14, 1899. The work of removal will be commenced during the present season with funds now available.

At Greenwich Point.—The survey was made in July, 1898, to determine the condition of the channel after the completion of dredging executed by the city of Philadelphia in 1898.

At Schooner Ledge.—The survey was made November, 1898, to determine the condition of the channel after the completion of dredging executed by the city of Philadelphia in 1898.

3. IMPROVEMENT AND SURVEY OF HOLLY OAK REACH.

No improvement of this shoal had been made previous to June 30, 1898.

During the past fiscal year a hydrographic survey of this part of the river, extending from Edgemoor to the Marcus Hook Ice Piers, was made for the purpose of determining the condition of the channel previous to undertaking its improvement by dredging.

Under date of July 22, 1898, contract was entered into with the River and Harbor Improvement Company, of Camden, N. J., for dredging a channel 26 feet deep at mean low water through the reach from Edgemoor to Marcus Hook as far as available funds would permit after the completion of dredging through the shoals at Cherry Island Flats, below Christiana River, and between Pennsville and Bulkhead Bar, provided for in the same contract. Work under this contract was commenced on this reach November 4, 1898, and completed May 24, 1899; no work being done from December 21, 1898, to April 7, 1899, during which time operations were suspended for the winter. The amount removed under the contract was 539,991 cubic yards, scow measurement.

The resulting channel has a least low-water depth of 26 feet over a width of 400 feet, with a length of 12,550 feet, and extends from a point opposite the stone wharf of Messrs. Hughes Bros. & Bangs at Bellevue, to the Cherry Island Range.

4. IMPROVEMENT AND SURVEY OF CHERRY ISLAND FLATS.

During the fiscal year ending June 30, 1897, the channel through this shoal was improved by dredging to a mean low-water depth of 26 feet over a width varying from 220 to 265 feet.

During the past fiscal year under the above-mentioned contract with the River and Harbor Improvement Company, dredging operations were in progress from August 24 to December 21, 1898, 513,435 cubic yards, scow measurement, having been removed under the contract.

The resulting channel has a least low-water depth of 26 feet over a width of 400 feet and a length of 9,700 feet, and extends from the channel through Holly Oak Reach to a point opposite the outer end of the jetty on the upper side of Christiana River. A survey of the channel was made after the completion of the dredging.

5. IMPROVEMENT AND SURVEY OF THE SHOAL BELOW CHRISTIANA RIVER.

This shoal was formerly included in the shoal at Cherry Island Flats. During the fiscal year ending June 30, 1897, the channel through this shoal was improved by dredging to a mean low-water depth of 26 feet over a width varying from 220 to 265 feet.

During the past fiscal year, under the above-mentioned contract with the River and Harbor Improvement Company, dredging operations were in progress from August 16 to November 21, 1898, 129,127 cubic yards, scow measurement, having been removed under the contract.

The resulting channel has a least low-water depth of 26 feet over a width of 400 feet, and extends from a point opposite the outer end of the jetty on the upper side of Christiana River, a length of 3,700 feet downstream to deep water.

A survey of the channel was made after the completion of the dredging.

6. IMPROVEMENT AND SURVEY OF SHOAL BETWEEN PENNSVILLE AND BULKHEAD BAR.

No improvement of this shoal had been made previous to June 30, 1898.

During the past fiscal year, under the above-mentioned contract with the River and Harbor Improvement Company, dredging operations were in progress from July 19 to September 27, 1898, 253,581 cubic yards, scow measurement, having been removed under the contract.

The resulting channel has a least low-water depth of 26 feet over a width of 400 feet and length of 6,320 feet, and extends in two reaches from a point opposite the upper end of New Castle downstream to the existing channel through Bulkhead Bar.

The total amount dredged under the contract with the River and Harbor Improvement Company at the four localities mentioned above was 1,436,134 cubic yards, and the total length of channel improved was 32,270 feet. The total cost of the work, including inspection and superintendence, was $112,438.06.

7. REPAIRING BULKHEAD BAR DIKE.

During the past fiscal year, under an informal agreement with the Delaware Construction Company, of Wilmington, Del., entered into October 4, 1898, 1,032 tons of stone were used for raising the original filling of the dike where depressions existed to about the level of the top of the upper wale, and 1,425 tons of stone were used in rebuilding 12 existing buttresses to a height equal to that of the top of the dike and in constructing one new buttress. The work was completed December 1, 1898. The cost of the work, including inspection and superintendence, was $3,200.

8. IMPROVEMENT AND SURVEY OF DAN BAKER SHOAL AND DUCK CREEK FLATS.

Under date of February 26, 1897, contract was entered into with the Morris & Cumings Dredging Company, of New York, for dredging a channel with a least depth of 26 feet at mean low water and a least width of 600 feet from deep water at the head of the bay to deep water above Dan Baker Shoal, the quantity of material to be removed during the current season being about 3,000,000 cubic yards, scow measurement. Work under this contract was commenced on April 2, 1897, and at the close of the fiscal year ending June 30, 1897, 756,316 cubic yards, scow measurement, had been removed. Under date of June 18, 1897, this contract was modified by authority of the Chief of Engineers, dated June 4, 1897, so as to provide for the formation of a channel 600 feet wide and 26 feet deep at mean low water from deep water above Dan Baker Shoal to deep water below Pea Patch Island by the removal of about 300,000 cubic yards of material, scow measurement, the work to be done at the same price, and completed on or before June 30, 1898.

During the fiscal year ending June 30, 1898, work was in progress under the above-mentioned contract until December 23, 1897, when it was suspended for the winter season. Operations were resumed March 21, 1898, and were still in progress on June 30, 1898, a total of 3,069,334 cubic yards, scow measurement, having been removed, making a total to that date of 3,825,650 cubic yards, scow measurement.

Under date of December 11, 1897, by the authority of the Chief of Engineers, the amount to be expended under the contract was increased from $300,000 to $340,000, and on March 28, 1898, the project was further modified to provide for a channel 400 feet wide and 26 feet deep at mean low water from deep water above Dan Baker Shoal to deep water below Pea Patch Island, at an additional estimated cost of $45,000, the work to be done at the same price and completed on or before September 30, 1898.

During the past fiscal year operations were in progress under the above-mentioned contract until August 10, 1898, when the contract was completed, 116,936 cubic yards, scow measurement, having been removed, making a total number of 3,942,586 cubic yards dredged under the contract.

As a result of the work done a channel of about 400 feet width and 26 feet depth, with a length of 16,000 feet, was formed through the shoal at Duck Creek Flats; a channel of corresponding depth, with a width varying from 300 to 500 feet and length of 23,000 feet, was formed through Dan Baker Shoal, and a channel of the same depth and 400 feet width, with a length of 7,750 feet, was formed through the shoal between deep water above Dan Baker Shoal and deep water below Pea Patch Island (off Salem Cove).

A survey was made of the dredged channels at Off Salem Cove and at Dan Baker Shoal in July and August, 1898. The dredged cut at Dan Baker Shoal was found at that time to have shoaled over about 6,000 feet of its length to its original depth of about 19 to 20 feet at mean low water. The total cost of the work, including inspection and superintendence, was $365,836.54.

MISCELLANEOUS.

Up to June 30, 1899, under authorities granted by the Secretary of War, the city of Philadelphia has removed 27,050 cubic yards of rock and other material from Schooner Ledge. The work was completed on June 19, 1899. The blasting and excavating have been carried to such depths and over such areas as to secure a channel 600 feet wide, with a depth of 26 feet through the former rock obstructions.

In addition to the above work, 1,667,246 cubic yards of material, scow measurement, have been dredged from the channel of the river at Greenwich Point, Mifflin Bar, and below the rock at Schooner Ledge. The channels were dredged to a least depth of 26 feet at mean low water. The work done was the removal of the middle ground at Greenwich Point, the formation of a channel 600 feet wide through Mifflin Bar, and the formation of a similar channel 200 feet in width below Schooner Ledge.

Detailed information with reference to this subject is given in a letter dated June 22, 1899, from Mr. Theodore C. Knauff, secretary of the Board of Harbor Commissioners, city of Philadelpha, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

During the fiscal year ending June 30, 1898, a survey of the river, made in accordance with the provisions of the river and harbor act of June 3, 1896, was completed from Philadelphia to deep water in the bay, and a project for further improvement submitted January 5, 1898.

The project provides for the formation by dredging and rock removal at Schooner Ledge, of a channel 600 feet wide and 30 feet deep at mean low water along the axis of the main ship channel from a point opposite Christian street, Philadelphia, to deep water in the bay, and for rock removal at Petty Island. The total cost of the work is estimated at

$5.935,000, on the basis of its execution under a continuous contract within six years after commencement.

The river and harbor act of March 3, 1899, provided for continuing the improvement of this river as follows:

> Improving Delaware River from Trenton to its mouth, Pennsylvania and New Jersey: Continuing improvement, three hundred thousand dollars, of which the Secretary of War may use so much as may, in his opinion, be required between Trenton and Christian street in Philadelphia, and the balance shall be available for obtaining a channel six hundred feet wide and thirty feet deep from said Christian street to deep water in Delaware Bay, in accordance with the report printed in House Document number two hundred and nineteen, Fifty-fifth Congress, second session, or such modified project as shall hereafter be recommended by a board of engineers and approved by the Secretary of War: *Provided*, That the total cost of the work shall not be increased thereby: *And provided further*, That the Secretary of War may enter into contract or contracts for such materials and work as may be required for prosecuting such improvement, not to exceed in the aggregate five hundred thousand dollars, to be paid for as appropriations may from time to time be made by law. The Secretary of War is hereby authorized to appoint a board of three engineers to make a further examination of the project and report such modification of the same as may be deemed desirable, with an estimate of the cost, the expense of such examination to be paid from the appropriation herein made.

A board of officers of the Corps of Engineers was constituted by Special Orders, No. 16, Headquarters, Corps of Engineers, United States Army, dated March 20, 1899, to consider and report on the project for obtaining a channel 600 feet wide and 30 feet deep, from Christian street, Philadelphia, to deep water in Delaware Bay, in accordance with the above provision of the river and harbor act of March 3, 1899. The board held its first meeting in Philadelphia on April 10, 1899, and after making an examination of the river, directed that a further survey be made of that portion of the channel between deep water above Dan Baker Shoal and deep water in Delaware Bay. This survey is now in progress and will probably be completed in July, after which the board will hold another meeting and prepare its final report.

A project for the expenditure of $125,000 of the above appropriation to be used for removing rock from the channel of the river opposite Petty Island (above Christian street, Philadelphia) was submitted on June 6, 1899, and approved June 14, 1899.

No estimate of the cost of completing the improvement of this river can be submitted until the board of engineers above referred to has made its final report.

The Delaware River is tributary to the following collection districts: Trenton, Philadelphia, Wilmington, and Bridgeton.

The amount of revenue collected in these districts during the year ending December 31, 1898, was $19,818,782.75.

Money statement.

July 1, 1898, balance unexpended	$203, 540. 19
Amount appropriated by river and harbor act approved March 3, 1899.	300, 000. 00
	503, 540. 19
June 30, 1899, amount expended during fiscal year	186, 265. 36
July 1, 1899, balance unexpended	317, 274. 83
July 1, 1899, outstanding liabilities	1, 726. 50
July 1, 1899, balance available	315, 548. 33
Amount that can be profitably expended in fiscal year ending June 30, 1901, should a project for a 30-foot channel be adopted	1, 000, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

Act of—		Act of—	
July 4, 1836	$15,000	July 5, 1884	$200,000
June 10, 1872	10,000	August 5, 1886	210,000
March 3, 1873	115,000	August 11, 1888	250,000
June 23, 1874	60,000	September 19, 1890	240,000
March 3, 1875	30,000	July 13, 1892	50,000
August 14, 1876	40,000	August 18, 1894	170,000
June 18, 1878	110,000	June 3, 1896	500,000
March 3, 1879	201,000	March 3, 1899	300,000
June 14, 1880	235,000		
March 3, 1881	250,000	Total	3,272,000
August 2, 1882	286,000		

Total amount appropriated on present project to June 30, 1899 .... $1,917,000

Expenditures.

Total to June 30, 1899	$2,954,725.17
Total on present project to June 30, 1899	1,599,725.17

Abstract of proposals for dredging between Bulkhead Bar and Marcus Hook Ice Piers, Delaware River, opened July 5, 1898, by Lieut. Col. C. W. Raymond, Corps of Engineers.

[Approximate quantity of material to be removed, 1,050,000 cubic yards.]

No.	Name and address of bidder.	Per cubic yard.	Amount.
		Cents.	
1	P. Sanford Ross, Inc., Jersey City, N. J	$9\frac{6}{10}$	$100,800.00
2	Atlas Dredging Co., Wilmington, Del	10	105,000.00
3	American Dredging Co., Philadelphia, Pa	$7\frac{4}{10}$	77,700.00
4	International Contracting Co., Syracuse, N. Y	$11\frac{3}{4}$	123,375.00
5	River and Harbor Improvement Co., Camden, N. J	$6\frac{7}{8}$	72,187.50
6	Baltimore Dredging Co., Baltimore, Md	10	105,000.00
7	Morris & Cumings Dredging Co., New York, N. Y	9	94,500.00
8	Virginia Dredging Co., Richmond, Va	$8\frac{44}{100}$	89,145.00
9	Frank H. Brainard, New York, N. Y	$9\frac{1}{2}$	99,750.00

Contract (dated July 22, 1898) entered into with the River and Harbor Improvement Company.

There were no contracts in force at the close of the fiscal year ending June 30, 1899, pertaining to this work.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River, for the years ending December 31, 1897 and 1898, are compiled from reports of the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	1897.	1898.	Articles.	1897.	1898.
IMPORTS.	*Tons.*	*Tons.*	IMPORTS.	*Tons.*	*Tons.*
Asphalt and asphalt blocks	12,508	8,471	Earthenware, china and stoneware	172	174
Burlap	12,337	11,510	Fertilizers	9,327	10,492
Cement	37,795	27,085	Fruits	9,716	9,707
Chalk	22,546	34,365	Glass, and manufactures of	928	882
Clay	19,198	16,163	Glue and glue stock	497	1,094
Coal	130	537	Groceries and provisions	6,550	4,794
Coal tar, and pitch of	1,354	1,282	Hair, and manufactures of	951	511
Cork and corkwood	952	646	Hemp, jute, flax, and their fabrics	20,509	106,300
Cotton and cotton fabrics	2,349	2,277			
Drugs and chemicals	80,310	72,806			

Commercial statistics—Continued.

Articles.	1897.	1898.
IMPORTS—continued.	*Tons.*	*Tons.*
Hides and skins	4,731	5,769
Iron, manufactures of	3,497	7,050
Iron, ore	194,814	112,608
Iron, pig	3,085	6,044
Iron, scrap	255	164
Leather, and manufactures of	195	192
Live stock and fowls	56	117
Mineral water	1,037	830
Molasses	377	5,602
Oil	1,924	1,535
Ores, metals, and manufactures of	128,559	1,119
Plants and seed	1,260	2,747
Plaster of paris	17,806	17,516
Rags	378	1,183
Salt	14,207	10,882
Silk, and manufactures of	121	106
Stone, and manufactures of	3,419	2,983
Sugar	452,726	364,931
Sulphur, crude	5,531	6,955
Sulphur, ore	53,623	46,341
Tin	12,842	17,649
Tobacco	218	144
Wines and liquors	1,308	1,012
Wood pulp, paper, and manufactures of	19,879	19,867
Wood, and manufactures of	4,479	2,702
Wool and wool fabrics	16,378	5,103
Miscellaneous	2,537	5,900
Total	1,182,807	949,097
EXPORTS.		
Beef, pork, and products	33,711	55,210
Bricks	....	395
Bran, middlings, and mill feed	....	5,360
Cars and locomotives	2,155	7,498
Coal	402,134	492,403

Articles.	1897.	1898.
EXPORTS—continued.	*Tons.*	*Tons.*
Corn and corn meal	705,868	841,148
Cotton and cotton fabrics	4,459	6,610
Drugs and chemicals	3,350	4,577
Fertilizers	671	352
Flour	86,409	171,129
Fruit	....	676
Glucose	9,887	11,612
Glue and glue stock	57	69
Groceries and provisions	8,677	9,629
Gunpowder and explosives	426	373
Hay	745	2,289
Hides, leather, and manufactures of	921	904
Iron, manufactured	18,039	15,055
Iron, ore	....	899
Iron, pig	3,886	2,038
Iron, scrap	2,151	100
Live stock	6,676	4,560
Metals, other, and manufactures of	478	3,939
Molasses	18,733	12,433
Oats and oatmeal	40,093	95,231
Oil cake	32,892	48,348
Oils, lubricating	32,044	48,801
Oils, other	136	3,080
Paraffin	18,358	13,082
Petroleum, crude and refined	990,796	873,468
Residium	....	24,568
Rye	....	40,894
Seeds	519	1,685
Soap, tallow, and grease	4,630	3,239
Stone, manufactured	....	8,572
Tobacco	5,666	2,381
Wheat	144,048	169,818
Wines and liquors	10	22
Wood pulp, paper, and manufactures of	....	1,316
Wood, and manufactures of	27,793	27,206
Miscellaneous	4,044	7,435
Total	2,599,962	3,018,975

Passengers arriving from and departing for foreign countries.

	1897.	1898.
Arriving	12,664	11,413
Departing	8,118	5,294
Total	20,782	16,707

Comparative statement of tons and values of exports, imports, and revenue collected.

Year.	Exports.		Imports.		Revenue.
	Tons.	Value.	Tons.	Value.	
1892	2,359,155	$60,274,024	1,429,636	$63,277,781	$10,886,475
1893	1,816,297	43,416,955	1,154,814	58,870,186	9,899,284
1894	1,861,578	37,441,000	1,164,572	51,553,704	8,456,183
1895	1,738,913	36,745,119	1,355,456	47,271,435	13,526,966
1896	1,875,081	42,431,100	1,151,722	39,807,278	12,657,803
1897	2,599,952	51,760,616	1,182,807	27,921,738	14,057,074
1898	3,018,975	59,392,047	949,097	28,066,746	19,818,783

Foreign entrances and clearances.

Class.	Entered from foreign ports.				Cleared for foreign ports.				Total.	
	With cargoes.		In ballast.		With cargoes.		In ballast.			
	Number.	Tons.	Number.	Tons.	Number.	Tons.	Number.	Tons.	Number.	Tons.
American steam vessels	6	7,689	3	1,546	3	1,146	6	8,012	18	18,393
American sail vessels	84	43,477	1	596	93	52,461	......	....	178	96,534
Foreign steam vessels	437	769,501	405	729,666	775	1,406,470	53	34,067	1,670	2,939,704
Foreign sail vessels	96	107,624	51	71,106	152	186,903	4	2,413	303	368,046
Total	623	928,291	460	802,914	1,023	1,646,980	63	44,492	2,169	3,422,677

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1897 and 1898, has been compiled from returns made to this office by shippers, consignees, and carriers:

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Brick and terra cotta	12,828	$40,132	36,036	$167,895
Cement and plaster	27,190	108,754	31,408	131,013
Chemicals	125,186	2,268,824	185,073	3,017,085
Coal	1,232,659	3,825,085	900,230	2,645,257
Cotton	8,227	985,755	4,347	437,444
Fertilizers	64,534	874,502	68,242	1,068,455
Grain	25,795	751,775	19,108	427,774
Hay	10,906	58,593	14,326	83,486
Ice	294,137	514,266	334,010	644,970
Iron, manufactured	116,626	3,442,602	27,016	1,420,489
Iron, pig	150,060	1,605,950	303,858	3,371,506
Iron, scrap	2,706	24,586	5,483	53,126
Lumber	769,218	4,722,070	857,619	4,725,923
Oysters and fish	22,917	777,342	20,700	741,470
Petroleum and products	10,409	198,919	74,581	857,416
Produce and fruit	62,825	1,032,365	29,488	549,758
Railroad ties	268,497	1,334,578	145,402	583,347
Sand	1,056,078	639,187	1,083,933	681,716
Stone, building	27,217	285,027	48,806	226,482
Stone, paving	70,223	120,716	169,327	525,592
Sugar	....	....	....	....
Wood, cord	75,701	307,068	34,246	111,567
Miscellaneous	1,455,875	243,497,529	1,306,362	318,657,088
Total	5,890,714	267,360,075	5,699,546	341,143,859
DEPARTING.				
Brick	8,172	51,479	7,720	87,800
Cement and plaster	....	....	5,300	35,000
Chemicals	28,492	2,239,863	93,263	2,316,005
Coal	5,873,680	17,668,281	5,138,750	15,281,522
Cotton	12,962	1,734,980	8,631	1,083,660
Fertilizers	59,797	1,206,723	71,785	1,309,881
Grain	8,786	182,780	6,371	99,855
Hay	1,000	6,000	....	....
Ice	300	600	580	1,160
Iron, manufactured	159,682	3,975,530	144,231	8,798,512
Iron, pig	29,998	329,843	29,040	328,040
Iron, scrap	....	....	1,000	10,000
Lumber	45,029	260,705	37,640	234,262
Manure	186,603	161,946	180,388	177,163
Oysters and fish	....	....	154,450	1,152,525
Petroleum	450,745	8,337,714	150,771	2,378,964
Produce	375	37,500	30,780	767,600
Sand	15,694	15,411	131,176	113,781
Stone, building	176,542	262,413	417,154	492,242
Wood, cord	....	....	1,350	5,050
Miscellaneous	1,342,158	244,002,789	1,298,120	290,225,229
Total	8,350,015	280,474,557	8,853,500	319,847,749

Passengers arriving at and departing from Philadelphia.

	1897.	1898.
Arriving	1,098,599	1,172,025
Departing	1,112,588	1,775,125
Total	2,211,187	3,547,150

Domestic and coastwise arrivals and departures in cargo.

Class.	1897.		1898.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	*a* 13,364	*a* 13,422	*a* 23,420	*a* 24,044
Sailing vessels	4,773	5,712	4,634	*b* 36,489
Canal boats and barges	24,334	25,028	*c* 30,059	*d* 29,744
Rafts	19	182	683	679
Total	42,490	44,344	58,796	90,956

a Excluding tugboats and ferryboats.
b Including 31,570 oyster boats.
c Including 11,056 railroad lighters.
d Including 10,048 railroad lighters.

SUMMARY.

Freight movement.

	1897.		1898.	
	Tons.	Value.	Tons.	Value.
Foreign:				
Arriving	1,182,807	$27,921,738	949,097	$37,516,707
Departing	2,599,952	51,760,616	3,018,975	59,392,047
Domestic:				
Arriving	5,890,714	267,360,075	5,699,546	341,143,859
Departing	8,350,015	280,474,557	8,853,500	319,847,749
Total	18,023,488	627,516,986	18,521,118	757,900,362

Vessel movement.

	1897.	1898.
Steam vessels, foreign trade, arriving	792	851
Sailing vessels, foreign trade, arriving	269	232
Steam vessels, foreign trade, departing	750	837
Sailing vessels, foreign trade, departing	283	249
Steam vessels, domestic trade, arriving	13,364	23,420
Sailing vessels, domestic trade, arriving	4,773	4,634
Canal boats and barges, domestic trade, arriving	24,334	30,059
Rafts, domestic trade, arriving	19	683
Steam vessels, domestic trade, departing	13,422	24,044
Sailing vessels, domestic trade, departing	5,712	36,489
Canal boats and barges, domestic trade, departing	25,028	29,744
Rafts, domestic trade, departing	182	679
Total	88,928	151,921

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE PROGRESS MADE BY THE CITY OF PHILADELPHIA IN THE WORK OF IMPROVING DELAWARE RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1899, WITH ONE INCLOSURE.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., June 22, 1899.

SIR: I beg to acknowledge the receipt of your communication under date of May 3, 1899, in which you ask to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1898, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

Under the head of the improvement of the Delaware River, I would report that work has been continued under contract No. 1, mentioned in last year's report for work at Schooner Ledge. At this point overlying materials and additional loose material at shoal spots in the channel, other than loose rock, have been removed previous to blasting the ledge rock. To date 112,815 cubic yards of this material, scow measurement, have been removed.

Of solid rock, blasted and dredged, 14,950 cubic yards have been removed to date from Schooner Ledge main rock and 10,200 cubic yards from Illinois rock, place measurement.

This work has been so done as to give a channel of 26 feet clear depth at mean low water with a width of 600 feet.

This work has been reported by the contractor as completed. The final examinations are now being made, which show but few variations above the required depth of 26 feet at mean low water. Before the end of the current month these will, in all probability, be removed.

Under contract No. 5, which was for the removal of the upper part of Schooner Ledge main rock not covered by contract No. 1, 1,900 cubic yards of rock were removed, giving a depth of 26 feet at mean low water. The final payment under the contract has been made and it has secured a clear depth of 26 feet at mean low water.

Contract No. 6 was for the removal of what is known as the middle ground opposite Greenwich Point, dredging across Fort Mifflin Bar, and the removal of shoals along Schooner Ledge range. The work under this contract has all been completed and has resulted in the formation of a channel at all these points of various widths and of 26 feet depth at mean low water.

For the statement of the details of these contracts, and of the work done under them, I am indebted to Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, a copy of whose communication, marked "A," is herewith inclosed.

Yours, truly,

THEO. C. KNAUFF, *Secretary.*

Lieut. Col. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, Pa., June 7, 1899.

DEAR SIR: Referring to your letter requesting a statement of the progress of the work being carried on by the city of Philadelphia upon the improvement of the channel of the Delaware River, I have to state that the following contracts have been in force and under execution during the year ending June 1, 1899:

Contract No. 1.—Consists of the removal of ledge rock and overlying material at Schooner Ledge, opposite Chester, Pa. Appropriation, December 28, 1894; contractor, the Philadelphia Public Works Company; date of contract, December 10, 1895; limit of contract, $175,000. Contract supplemented March 22, 1897, by an additional appropriation of $125,000 by authority of ordinance of councils, making the total limit $300,000.

In addition to the overlying materials removed, before beginning the operation of blasting the ledge rock, additional loose material other than rock has been removed from shoal spots within the channel lines, making an aggregate of 112,815 cubic yards, scow measurement, removed to date.

The work of blasting and dredging the rock and depositing the excavated materials back of Chester Island has been in progress.

About 10,200 cubic yards have been removed from Illinois rock, and from Schooner Ledge main rock 14,950 cubic yards of rock, place measurement, have been removed to date.

The blasting and excavating have been carried to such depths and over such areas so as to obtain a channel 600 feet wide with a clear depth of 26 feet at mean low water.

The work upon this contract was reported completed by the contractor on May 23, 1899.

Final sweepings and examinations for a bottom of at least 26 feet below mean low water are now in progress and indicate but a few points above the required depth, and these will probably all be removed before the end of the current month.

Contract No. 5.—This consisted of the removal of the upper portion of Schooner Ledge main rock not covered by contract No. 1.

Work was authorized April 13, 1896; contractor, H. T. Dunbar & Co.; date of contract, June 3, 1897; amount of contract, $28,000.

There was removed a total of 1,900 cubic yards of rock at a cost of $26,600. Final payment was made on December 28, 1898.

The work of blasting and excavating of rock under this contract has been carried to such depths as to obtain a clear depth of 26 feet at mean low water.

Contract No. 6.—This work consisted, first, of removing what is known as the middle ground in the Delaware River, opposite Greenwich Point coal wharves, extending between the prolongation of Avenue 38 south and the prolongation of Morris street or southern limit of the Philadelphia Harbor improvement; second, dredging a channel across Fort Mifflin Bar; third, the removal of shoals along Schooner Ledge Range.

Work authorized April 13, 1896. Contractor, American Dredging Company. Date of contract, June 3, 1897. Amount of contract, $315,000. There were removed from Greenwich Point 1,013,674 cubic yards, from Fort Mifflin Bar 411,814 cubic yards, from Schooner Ledge Range 241,758 cubic yards, making a total of 1,667,246 cubic yards, all of which was deposited beyond high-water mark on Mud Island, on the west bank of the Schuylkill River, opposite League Island. The work upon this contract was completed on September 15, 1899, and final estimate of $314,692.68 paid on November 7, 1898.

The work under this contract resulted: First, at Greenwich Point, in the formation of a channel 26 feet deep at mean low water, from 950 to 1,050 feet in width, and extending southwardly from Morris street 1.9 miles; second, on Fort Mifflin Bar, in the formation of a channel through the bar, 26 feet deep at mean low water, 600 feet wide, and 1.3 miles in length; third, along Schooner Ledge Range, in the formation of a channel 26 feet deep at mean low water, 200 feet wide, and extending from the rock area at Schooner Ledge to the lower ice piers at Marcus Hook, a distance of 1.8 miles.

Date.	Description.	Amount.
Dec. 28, 1894	Allotment for removing impediments to navigation	$185,000
Apr. 13, 1896	Improving channel of Delaware River (loan)	500,000
	Total	685,000

Yours truly,

G. S. WEBSTER, *Chief Engineer.*

Mr. THEO. C. KNAUFF,
Secretary Board of Harbor Commissioners.

H 2.

IMPROVEMENT OF HARBOR BETWEEN PHILADELPHIA, PENNSYLVANIA, AND CAMDEN, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 897; 1897, page 1205, and 1898, page 1085.

On February 3, 1898, after the completion of the dredging, a project was approved for the expenditure of $11,200 in making a survey of the harbor, including gaugings of flow and determination of velocities, measurements of dumps, repair of plant, preparation of maps, and engineering expenses and contingencies, supplementing the completion of the widening of the channels between Philadelphia and Camden and north of Petty Island by dredging.

During the past fiscal year work under this project was in progress until June 15, 1899, when it was completed. A final report on the improvement was submitted June 15, 1899, a copy of which is appended hereto.

No further appropriation is required for this improvement.

During the past fiscal year projecting points of the rock opposite Rush street and below Cramp's shipyard were blasted down by the use of dynamite derived from the unloading of the submarine mines in use at Fort Delaware during the late war, and the navigable conditions were much improved thereby. The average low-water depth over the rock still remains at about 23 feet. No work of improvement under the general project was done during the year.

Surveys and examinations made during the past fiscal year show that the increased depth has been well maintained, no shoaling having been found within the limits of the improved channel except along the face of Petty Island and above Erie avenue, where the wharves have not yet been extended to the new pierhead line.

During the past fiscal year six piers, including four previously commenced, were extended fully to the new line, and permission was given by the board of port wardens for the extension of three others. Three piers are now under construction.

Up to June 30, 1899, twenty-three wharves between Ann street and Queen street, on the Philadelphia front, have been extended to the new pierhead line, and between Pearl and Mickle streets, Camden, five wharves have been similarly extended to the New Jersey pierhead line.

The city of Philadelphia is now constructing along the new bulkhead line, from Vine to South streets, a bulkhead which, when completed, will permit the widening of Delaware avenue at that locality to 150 feet.

Detailed information with reference to these subjects is given in a letter dated June 22, 1899, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

The commercial statistics pertaining to this work are included in the statistics accompanying the report for the improvement of Delaware River.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1898, revenue to the amount of $19,791,682.75.

The nearest fort and light-houses are, respectively, Fort Mifflin and Upper Horseshoe range lights.

Money statement.

July 1, 1898, balance unexpended	$2,404.06
June 30, 1899, amount expended during fiscal year	2,316.36
July 1, 1899, balance unexpended	87.70

Appropriations.

Act of—		Act of—	
August 11, 1888	$500,000	March 2, 1895	$850,000
September 19, 1890	200,000	June 11, 1896	600,000
March 3, 1891	300,000	June 4, 1897	694,000
August 5, 1892	41,000		
March 3, 1893	500,000	Total	3,935,000
August 18, 1894	250,000		

Total appropriations for part payment for land	$300,000
Total appropriations under present project to June 30, 1899	3,635,000
	3,935,000

Expenditures.

Total to June 30, 1899		$3,934,912.30
Under present project, for dredging and removal of pile and timber revetment	$3,279,196.72	
For depositing and spreading material on League Island	355,715.58	
For part payment of land	300,000.00	
		3,934,912.30

FINAL REPORT OF LIEUT. COL. C. W. RAYMOND, CORPS OF ENGINEERS UPON THE IMPROVEMENT OF THE HARBOR BETWEEN PHILADELPHIA, PA., AND CAMDEN, N. J.

ENGINEER OFFICE, U. S. ARMY,
Philadelphia, Pa., June 15, 1899.

GENERAL: I have the honor to submit the following final report upon the improvement of the harbor between Philadelphia, Pa., and Camden, N. J. This work was completed during the fiscal year ending June 30, 1898, but the submission of a final report was deferred until the harbor could be surveyed and the volumes of flow in the various channels determined. This information was obtained during the past fiscal year.

PROJECT FOR IMPROVEMENT.

Before the commencement of this improvement the islands in the Delaware River between Philadelphia and Camden compelled the flood and ebb currents to pursue different paths, narrowed the channels, and prevented the extension of wharves necessary for the purposes of commerce. The work of improvement was executed under a project recommended by a board of engineers on March 30, 1888, and adopted by Congress in the river and harbor act of September 19, 1890.[1] It proposed the formation by dredging of a channel about 2,000 feet wide, extending along the Philadelphia shore from opposite Kaighn Point to opposite Fishers Point, at a distance far enough from the wharf line, not exceeding about 300 feet, to permit the extension of the wharves and the widening of Delaware avenue at their shore ends. It provided for the removal of Smith and Windmill islands and adjacent shoals and a part of Petty Island, so as to give a depth of 26 feet at mean low water in a channel about 1,000 feet wide along the revised Philadelphia wharf line, decreasing to a depth of about 12 feet at mean low water along the New Jersey front, and the building out of the Philadelphia and Camden shores, so as to preserve a cross section of about 55,000 square feet at mean tide. The reconstruction of the water fronts to conform to the new conditions was to be executed during the progress of the improvement at the expense of the cities of Philadelphia and Camden or the riparian owners. The estimated cost of the dredging was $3,500,000.

This project was modified by Congress in the sundry civil act of March 3, 1891, and the river and harbor act of July 13, 1892, so as to provide for the deposit and spreading on League Island of a part of the excavated material as a filling for the island. The total quantity of material to be removed was estimated at 21,500,000 cubic yards, scow measurement. The general features of the improvement are shown on the sketch transmitted herewith. Maps showing the location of the works proposed and the condition of the harbor before, during, and after improvement are published in the Annual Reports of the Chief of Engineers for 1888, 1891, 1892, 1895, and 1898.

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[1] Annual Report of the Chief of Engineers for 1888, page 679.

APPROPRIATIONS.

The following appropriations were made for the work:

River and harbor act of August 11, 1888	$500,000
River and harbor act of September 19, 1890	200,000
Sundry civil act of March 3, 1891	300,000
Sundry civil act of August 5, 1892	41,000
Sundry civil act of March 3, 1893	500,000
Sundry civil act of August 18, 1894	250,000
Sundry civil act of March 2, 1895	850,000
Sundry civil act of June 11, 1896	600,000
Sundry civil act of June 4, 1897	694,000
Total	3,935,000

The act of August 11, 1888, provided that no part of the sum appropriated should be expended until the title to the lands forming the islands should be acquired and vested in the United States without charge to the latter beyond $300,000.

The act of September 19, 1890, authorized the Secretary of War to enter into contracts for the improvement in accordance with the plan of the board of 1888, the work to be paid for as appropriations might from time to time be made by law. The improvement was thus placed under the continuing contract system.

The act of March 3, 1891, authorized a change in the line limiting the excavation on Petty Island, the additional land to be obtained without charge to the United States, and provided that all the material to be removed should be deposited and spread on League Island.

The river and harbor act of July 13, 1892, authorized the deposit of any part of the material in any place or places approved by the engineer officer in charge of the work, provided that the full amount of material to be deposited and spread on League Island, as provided for under the existing contract, should be so deposited and spread before the completion of the work covered by the contract.

SUMMARY OF ANNUAL OPERATIONS.

A detailed account of the progress of the work, the methods employed and the results obtained, is published in the Annual Reports of the Chief of Engineers from 1890 to 1898, inclusive. The following brief summary of the operations for each fiscal year seems, therefore, to be all that is necessary in this report.

1889.—Smith and Windmill islands were condemned, their value being placed at $484,000.

1890.—The part of Petty Island to be removed was condemned, its value being placed at $202,288.50. The legal costs of all the comdemnation proceedings were $22,364.36, making the aggregate cost of the property taken $708,652.86. Payments for this property were completed on June 27, 1890, as follows:

By the United States	$300,000.00
By the State of Pennsylvania	200,000.00
By the city of Philadelphia	208,652.86
Total	708,652.86

1891.—On April 23, 1891, a contract was entered into with James A. Mundy & Co., of Philadelphia, for all the work required for the improvement. The work was to be executed at the following rates:

1. For material excavated and deposited at places provided by the contractor, 10⅞ cents per cubic yard, measured in the scows.
2. For the removal of wharfing or revetment, $1.90 per linear foot.

3. For dredged material deposited and spread upon League Island, an additional price of 9½ cents per cubic yard, measured in the scows.

Work was commenced on May 13, 1891, and during the year 10,318 cubic yards of material were removed from Windmill Island and deposited near League Island preparatory to placing it on the island, and the removal of the revetment was commenced.

Harbor lines were established by the Secretary of War, extending from Kaighn Point to Cooper Point on the Camden side, and from Moore street to Otis street on the Philadelphia side of the harbor.

The approved project for the execution of the work is published in the Annual Report of the Chief of Engineers for 1891, p. 1061.

1892.—During this year 2,330 linear feet of piling and revetment were wholly removed, and 923 linear feet were removed to low water; 312,111 cubic yards of material were dredged from Windmill Island and the adjacent shoal, and 287,736 cubic yards of dredged material were deposited on League Island.

1893.—Under the contract with James A. Mundy & Co., 5,495 linear feet of revetment were removed; 483,283 cubic yards of material were dredged from Windmill Island and the adjacent shoal, and 327,228 cubic yards of material were deposited on League Island. This contract was annulled on December 23, 1892.

On June 1, 1893, a contract was entered into with the American Dredging Company of Philadelphia for all the work required for completing the improvement. The work was to be executed at the following rates:

1. For material excavated and deposited at places approved by the engineer officer in charge, 14$\frac{8}{10}$ cents per cubic yard, scow measurement.
2. For the removal of wharfing or revetment, $1.90 per linear foot.
3. For dredged material deposited and spread on League Island, an additional price of 16 cents per cubic yard, place measurement, as measured in the fill.

Under this contract 112,825 cubic yards of material were dredged during the year.

One wharf and about 650 feet of bulkhead were constructed by private parties on the new lines along the Camden water front.

1894.—Smith and Windmill islands were removed to a level of not less than 12 feet below mean low water, and the northern side of Petty Island was dredged back so as to give a minimum width of about 1,400 feet to the Pennsylvania channel at that locality. The amount excavated from the islands and adjacent shoals was 4,924,390 cubic yards and the amount deposited on League Island was 1,021,123 cubic yards, scow measurement.

The harbor lines previously established were revised and extended to Harrison street on the Philadelphia side and to Fishers Point on the Camden side of the harbor.

One wharf and 500 feet of bulkhead were constructed by private parties on the new lines along the Camden water front.

1895.—Smith and Windmill islands were removed to an average depth of 18 feet below mean low water; the northern side of Petty Island was dredged back so as to give an average low-water width of about 1,700 feet to the Pennsylvania channel at that locality; the removal of all the revetments was completed, and the filling of League Island was continued. The amount excavated from the islands and adjacent shoals was 4,597,365 cubic yards; the amount deposited on League Island was 719,526 cubic yards, scow measurement; and the amount of revetment removed was 2,184 linear feet.

Work was commenced by private parties on the extension of four piers along the Philadelphia front and one pier was fully extended to the new line.

1896.—Smith and Windmill islands were removed to an average depth of 23 feet at mean low water, and the northern side of Petty Island was dredged back so as to give an average low-water width of about 1,900 feet to the Pennsylvania channel at that locality, and the filling of League Island was nearly completed. The amount excavated from the islands and adjacent shoals was 4,488,837 cubic yards and the amount deposited on League Island was 634,245 cubic yards, scow measurement.

Work was commenced by private parties on the extension of four piers along the Philadelphia front and the four piers previously commenced were fully extended to the new line.

1897.—Smith and Windmill islands were removed to an average depth of 25 feet at mean low water, dredging along the northern side of Petty Island was continued, and the work of filling League Island was completed. The amount excavated from the islands and adjacent shoals was 3,956,027 cubic yards and the amount deposited on League Island was 594,766 cubic yards, scow measurement.

Work was commenced by private parties on the extension of four piers along the Philadelphia front and three piers previously commenced were extended fully to the new line.

1898.—Smith and Windmill islands were removed to a least depth of 26 feet at mean low water and the dredging in the channel north of Petty Island was finished. The improvement was fully completed on January 10, 1898.

During the year six piers, including four previously commenced, were fully extended to the new line along the Philadelphia front.

PLACES OF DEPOSIT.

One of the greatest difficulties encountered in the execution of the improvement was to obtain places for the deposit of the excavated material without injury to the river or to riparian interests. It was impossible to deposit material in any part of the river without more or less interference with the fishing interests, and objections to such deposits were almost constantly made by persons who assumed that they were necessarily injurious to the channel. The following statement shows the disposition finally made of the dredged material.

	Cubic yards.
On shore at League Island	3,585,062
On shore at Petty Island	3,221,191
In Mifflin Basin	3,764,515
Above Pensauken Creek	799,066
Behind Marcus Hook Bar	5,338,511
Along New Jersey shore at Red Bank	3,829,641
For foundations for 18 piers, Philadelphia Harbor	537,149
Between Fishers Point Dike and Petty Island	153,542
Behind Fishers Point Dike	28,744
Along shore at League Island inside the limiting line of scour	30,551
For filling of thalweg between Callowhill street and Fairmount avenue, and off Arch street, Philadelphia Harbor	9,453
For foundation of city bulkhead, Philadelphia	5,587
For foundation of Pennsylvania Railroad ferry slip, Philadelphia	69,566
For filling along inside face of revetment on north and south side of Petty Island	26,728
For filling along outer face of revetment on north and south side of Petty Island	51,002
For use on dike at mouth of Schuylkill River	2,498
For foundation of dike on east side of Schuylkill River	18,721

	Cubic yards.
For dry-dock pier, League Island	27,494
In meadow bank, north side of Petty Island	78,415
On American Dredging Company's land, Camden	1,792
In Howells Cove and above Billingsport near New Jersey shore during storm	1,603
In gap in bank near upper end of Petty Island	7,054
For Pennsylvania Railroad Bridge approach at Bridesburg, inside pier-head line	12,263
At United States Sugar Refining Company's wharf, Camden, N. J	4,830
On Cooper street wharf, Camden, N. J	63
Total	21,605,061

From careful surveys and measurements made during the progress of the work it appears that no injuries to the channel have resulted from the deposit of dredged material within the limits of the waterway, and in some cases the main channel has been decidedly improved thereby.

PLANT.

Under the contract with James A. Mundy & Co. from 1 to 9 grapple, scoop, combination, and elevator dredges were used for the excavation of material. A pile driver and derrick scow were used for the removal of revetment in addition to the dredges. The scow plant varied from 11 to 24 pieces. During 1891–92, material was placed on League Island by grapple dredges, a centrifugal pump, a hydraulic dredge, and 3 pulsometers.

During part of the time the dredges cast material directly over the bank; at other times they were employed in rehandling material for the pulsometers. The pump and hydraulic dredge were only used temporarily.

The first pulsometer installed pumped from the bottom, but afterwards it was arranged to pump directly from the scows. Two additional pulsometers were then added to the plant to pump in the same manner.

Under the contract with the American Dredging Company, from 4 to 15 grapple, scoop, combination, and hydraulic dredges, 79 dump scows, and 6 to 24 tugboats were used in the excavation. For the placing of material ashore at League Island, 3 hydraulic and 2 grapple dredges and 2 pulsometers were employed; hydraulic dredges were first used, then a combination of hydraulic dredges and pulsometers, and the work was finally completed with 2 hydraulic dredges, 1 grapple dredge being used for filling in behind the wall protecting the face of the island.

All material deposited on Petty Island was pumped ashore by three hydraulic dredges from the excavation direct to the fill.

SUMMARY OF THE WORK.

The total amount of work accomplished in this improvement was as follows:

Material removed by dredging, scow measurement	cubic yards..	21,605,061
Piling and revetment removed	linear feet..	24,848
Dredged material deposited and spread on League Island, scow measurement	cubic yards..	3,585,082

SUMMARY OF COST.

The cost of the work, including engineering, administration, and the purchase of land, was as follows:

For purchase of land	$708,652.86
For harbor improvement	3,268,084.42
For improving League Island	355,715.58
For surveys and gaugings since the completion of the improvement	11,074.80
Total cost of the work	4,343,527.66
Paid by State of Pennsylvania and city of Philadelphia for land	408,652.86
Total cost to the United States	3,934,874.80

MISCELLANEOUS.

The cost of dredging for the harbor improvement was estimated by the Board of Engineers of 1888 at $3,500,000. The actual cost was $3,253,511.29.

The quantity of material to be removed was estimated at about 21,500,000 cubic yards, scow measurement (Annual Report of the Chief of Engineers for 1893, p. 1153.) The quantity actually removed was 21,605,061 cubic yards, scow measurement.

The estimates submitted to the Department on January 28, 1893, gave as a reasonable price for the dredging 14.5 cents per cubic yard, scow measurement, and 10 cents per cubic yard as the probable cost of placing material on shore. The price of dredging under the second contract was 14.2 cents per cubic yard, scow measurement. The actual cost of placing material on League Island was 9.97 cents per cubic yard, scow measurement.

The greatest calendar year's work was done in 1894, when 5,999,162 cubic yards of material were dredged and 1,342,366 cubic yards were placed on League Island.

The cost of superintendence was large, owing to the necessity of having a Government inspector on every dredge and at every place of deposit. The engineering and contingent expenses were 4.86 per cent of the total cost of the work.

PHYSICAL RESULTS OF THE WORK.

Before the commencement of the improvement it was considered of the highest importance that the removal of the islands and shoals should be accompanied by the simultaneous advance of piers to the new harbor lines on both shores of the river, so as to maintain the assigned section of the new channel, and it was believed that a failure to enforce this condition would be followed by serious shoaling. The piers were advanced as rapidly as was necessary, and no shoaling has occurred in the main part of the harbor either during the progress of the work or since its completion. Slight shoaling has occurred in the extreme upper part of the harbor, where as yet no piers have been advanced to the new line, but this is of no consequence, and the full depth will be rapidly regained when the piers are constructed. The channel of this part of the harbor has been greatly benefited by the construction of the railroad bridge crossing the river at Fishers Point.

It was believed that shoaling would occur in the channel opposite Cooper Point, unless the dike at Fishers Point were extended so as to close the channel south of Petty Island and thus do away with the conflict of tidal currents at the foot of the island. As the legislature of

New Jersey and other public bodies protested against the extension of the dike, the channel south of Petty Island was left partly open; but up to the present time the depth opposite Cooper Point has been well maintained.

The improvement of the harbor as regards the directions of the tidal currents has been very great. The main flood and ebb currents now follow essentially the same path, parallel to the pierhead lines, instead of separating in the lower part of the harbor and crossing each other below Petty Island, as they did before the removal of the islands and the rectification of the channel.

The most important improvement in the conditions of flow has been made in the channels north and south of Petty Island. Seven flood and five ebb tides were gauged simultaneously in the channels in June, 1898, after the completion of the improvement. The following information is obtained from these observations:

	Cubic feet.
Average volume of flood flow up north channel	1,489,699,336
Average volume of flood flow up south channel	382,411,393
Average total volume of flood flow	1,872,110,729

	Per cent.
Percentage of volume of flood flow, north channel	79.6
Percentage of volume of flood flow, south channel	20.4

	Cubic feet.
Average volume of ebb flow down north channel	1,921,460,346
Average volume of ebb flow down south channel	500,031,724
Average total volume of ebb flow	2,421,492,070

	Per cent.
Percentage of volume of ebb flow, north channel	79.4
Percentage of volume of ebb flow, south channel	20.6

The conditions existing in these channels before improvement are given in a paper submitted on May 8, 1883, to the United States commission advisory to the harbor commissioners of Philadelphia by Prof. Henry Mitchell, of the United States Coast and Geodetic Survey. A comparison of these conditions with those now existing is given in the following table:

	1878.	1898.
Area of section:		
North channel ... square feet	38,587	59,691
South channel ... do	30,147	22,494
Mean depth of section:		
North channel ... feet	21.3	27.1
South channel ... do	13.4	13.3
Ratio of flood discharge between north and south channels	1 to 0.64	1 to 0.26
Ratio of ebb discharge between north and south channels	1 to 0.68	1 to 0.26

The areas and mean depths in the above table are for a height of 4 feet above mean low water.

RECONSTRUCTION OF THE WATER FRONTS.

The construction of piers and bulkheads on the new lines to conform to the physical conditions of the rectified harbor was a work of great importance and considerable difficulty. The piers were gradually advanced from time to time to conform to the changing conditions of the improvement. The work was done by the cities and private owners, but always under the direction and advice of the Government engineer. Up to the present time the following work been accomplished:

Twenty-three wharves between Ann street and Queen street on the Philadelphia front have been extended to the new pierhead line, and between Pearl and Mickle streets, Camden, five wharves have been similarly extended to the New Jersey pierhead line, and three wharves are under construction. On the Philadelphia front nine additional wharves have been widened or partly extended to the new pierhead line, and seven new ferry slips have been built. The city of Philadelphia is now constructing the bulkhead from Vine to South streets and widening Delaware avenue over the same locality to a least width of 150 feet. About 75 per cent of this work has been completed.

From the commencement of the improvement until its completion the work has been assisted by the earnest, cordial, and efficient cooperation of the authorities of the city of Philadelphia and the principal commercial organizations. Special mention should be made of the board of harbor commissioners of Philadelphia and the department of surveys of the city government.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE IMPROVEMENT BY THE CITY OF THE HARBOR OF PHILADELPHIA BY MEANS OF THE WIDENING OF DELAWARE AVENUE AND THE EXTENSION OF PIERS BY PRIVATE OWNERS.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, June 22, 1899.

SIR: I beg to acknowledge the receipt of your communication under date of May , 1899, in which you asked to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1898, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

Under the head of the further improvement by the city, of the harbor of Philadelphia by means of the widening of Delaware avenue, I would report as follows:

The work has been carried on under the contracts given in the previous year. The claims of private owners for damages have not yet all been settled, but it is expected they will be shortly.

Contract No. 5, for sewers on Delaware avenue between Vine and South streets, has been completed, and payments have been made amounting to $18,824.20.

Contract No. 6, for sewers between Market and Pine streets, has also been completed, and the total cost, $19,826.64, paid.

Under these two contracts work has been done which gives proper drainage to all the Delaware avenue properties. The sewage has been intercepted and now discharges at or near the pierhead line instead of at the head of the docks.

The work on Delaware avenue includes the widening of the avenue from 50 to 150 feet, the construction of a bulkhead wall of concrete on the easterly line of the avenue (the river side), the filling in of the widened area, and a temporary paving of granite blocks on gravel base. The bulkhead has been completed for about 75 per cent of its length, and the greater part has been filled in and paved. There has been paid on this contract $319,882.31 to date.

The details of these plans and contracts and information as to the work of enlarging the piers owned by the city will be found in full in the inclosed communication from Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, marked "Inclosure A."

The list of licenses granted during the year by the board of port wardens for pier extension will be found in full in the accompanying letter from Mr. George F. Sproule, secretary of the board of port wardens, marked "Inclosure B."

Yours, truly,

THEO. C. KNAUFF, *Secretary.*

Lieut. Col. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVE
Philadelphia, Pa., June

DEAR SIR: Replying to your request for a statement of the progress of carried on by the city of Philadelphia for the betterment of the harbor, report as follows:

The city of Philadelphia has carried on the work of widening Delawar during the current year under contracts entered into during the year 1897.

All the damages for the widening of the avenue have not yet been adju it is probable that all claims will be settled in a short time.

The following contracts have been in progress:

Contract No. 5.—For the construction of sewers on Delaware avenue betw and Market streets. Contractor, D. J. McNichol. Date of contract, Septe 1897. Limit of contract, $20,000. Total cost, $18,824.20. Final estim January 27, 1899.

Contract No. 6.—Sewers on Delaware avenue between Market and Pine Contractor, D. J. McNichol. Date of contract, September 22, 1897. Limit of c $25,000. Total cost, $19,828.64. Final estimate paid January 27, 1899.

This work resulted in giving proper drainage facilities to all the prope Delaware avenue, and intercepting the sewage, diverting it from the head docks, and discharging it at or near the pierhead line.

The work of widening the avenue consisted of the construction of a bulkh of concrete on the easterly line of Delaware avenue, the avenue havin widened from a least width of 50 feet to a least width of 150 feet, all upon t erly or river side with the exception of a portion south of Lombard street affected about one dozen buildings.

The construction incident to the widening of Delaware avenue consisted i tion to the bulkhead, of the filling in of the widened area and paving with blocks on a gravel base, which paving was intended to be temporary only. was all comprised under a contract known as contract No. 7. Contractor, McNichol. Date of contract, September 18, 1897. Limit of contract, $475,000.

Work authorized by ordinance of councils, April 13, 1896, and November 2 The latter ordinance authorized the sum of $650,000 for the construction of the head and building sewers to be set aside by the city of Philadelphia, trustee, the will of Stephen Girard.

The bulkhead wall has been completed for about 75 per cent of its lengt the avenue filled in and paved over for a large portion of its length.

There has been paid to date, on account of this contract, $319,882.31.

The ordinance of April 13, 1896, authorized the widening and extension of pi the foot of Chestnut street, Arch, Race, and Dock streets. The property at street was turned over to the Pennsylvania Railroad under a lease of fifteen which lease carried with it an obligation to construct the pier, all of whic authorized by ordinance of councils.

Contracts for pier construction have been entered into as follows:

At the foot of Chestnut street, known as contract No. 8. Contractors, Arms & Printzenhoff. Date of contract, November 11, 1897. Limit of contract, $4 Dimensions, 80 feet by 554 feet. The pier was completed and final estimate September 6, 1898. Total cost, $45,489.01.

Extension of pier at the foot of Arch street, contract No. 9. Contractors, Arms & Printzenhoff. Date of contract, November 11, 1897. Limit of contract, $43 Dimensions, 80 feet by 531 feet. The work was completed and final estimate September 6, 1898. Total cost, $39,490.14.

Superstructure for pier foot of Arch street, contract No. 11. Contractors, Rya Kelly. Date of contract, September 13, 1898. Limit of contract, $27,000. work was completed and final estimate paid March 27, 1899. Total cost, $24,997 The superstructure consisted of a steel roof truss on steel columns. The si inclosing the pier is of corrugated iron; ornaments of cast iron.

Superstructure for the pier at the foot of Chestnut street, contract No. 12. C tractors, Armstrong & Printzenhoff. Date of contract, March 2, 1899. Limit contract, $90,000. The work consists of steel columns supporting latticed gird with corrugated iron covering on lower deck and cast iron ornamentation, w covered pavilion 70 feet by 140 feet. The upper-deck pavilion is all of copper, flooring of granolithic. The work included the construction of a footbridge, 150 f span, across Delaware avenue, with steps as approaches on the north and sou footways of Chestnut street.

There has been paid to date on account of this work $34,009.02.

Extension of the pier at foot of Race street: License was granted the city Philadelphia March 7, 1898, which called for pier 80 feet by 540 feet in length. A appeal was made by adjoining owners from the decision of the board of port warden

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which has been contested in the courts and not sustained. The city has acquired additional property to the south of Race street which will permit of a modified application being made to the board of port wardens for placing the pier in a different locality. This will permit of the extension of another pier immediately to the north of Race street. Plans are prepared and it is proposed to proceed with the construction in a short time.

Widening of Delaware avenue.

Date.	Description.	Amount.
Apr. 13, 1896	Building bulkhead piers, paving, damages, etc. (loan)	$1,500,000
Nov. 27, 1896	Building bulkhead and laying appurtenant sewer, etc. (agreement and appropriation by the trustees of the Girard estate)	650,000
	Total	2,150,000

Yours, truly,

G. S. WEBSTER, *Chief Engineer.*

INCLOSURE B.

BOARD OF PORT WARDENS FOR THE PORT OF PHILADELPHIA, PA.,
Philadelphia, May 11, 1899.

DEAR SIR: In compliance with the request contained in your favor of the 9th instant, I beg to submit below a list of the licenses granted by the board of port wardens for the extension of piers from June 30, 1898, up to the present time.

July 13, 1898, Philadelphia and Reading Railway Company, to construct a pier on the Delaware River immediately north of Callowhill street.

November 7, 1898, Delaware River Ferry Company, to construct a ferry slip at the foot of South street.

November 7, 1898, The William Cramp & Sons Ship and Engine Building Company, to extend Plum street pier.

March 6, 1899, Philadelphia and Reading Railway Company, to widen and extend piers A and G, Port Richmond.

April 3, 1899, Philadelphia and Reading Railway Company, to construct a pier in Port Richmond, to be known as Pier C.

Very truly, yours,

GEO. F. SPROULE, *Secretary.*

H 3.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 915.

Work under the contract dated November 6, 1896, with the Virginia Dredging Company, of Richmond, Va., for dredging a channel across the bar at the river's mouth, was completed April 21, 1897. Under this contract 62,983 cubic yards of material, scow measurement, were dredged.

During the fiscal year ending June 30, 1898, under an informal agreement entered into January 28, 1898, with John L. Grim, of Philadelphia, Pa., the pile dike at the mouth of the river was raised by spiking two courses of 12-inch by 12-inch pine lumber to the top of the sheet piling along the front and end walls, a total distance of 1,734 feet, at a cost of $1,673.77, including inspection and superintendence.

In April and May, 1898, by purchase of materials and hire of labor in open market, the earthen dike at the same locality, which had become badly eroded, was repaired by restoring the bank to its original cross section and revetting the outer slope with stone for a distance of 410 feet, at a cost of $656.80, including inspection and superintendence.

During the past fiscal year the filling of the pile dike was raised to the level of the face wall by the deposit of coarse gravel and bowlders, at a total cost of $813.72.

It is proposed to apply the sum of $11,100, which remains unallotted and available, to further improvement of the channel and repair of dikes at the mouth of the river; but it is considered desirable to defer the channel work until the effects of the currents under the new conditions have been determined.

During the past four years the city of Philadelphia has been engaged in improving the channel of this river under authorities of the Secretary of War dated September 3, 1895, and May 14, 1896. Up to the end of the past fiscal year about 525,918 cubic yards of material, as measured in the dump, had been removed from the channel and placed ashore.

Detailed information with reference to this subject is given in a letter dated June 22, 1899, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter is appended hereto.

These works have resulted in the formation of a channel with a minimum low-water depth of 24 feet and a minimum width of about 125 feet through the bar at the mouth of the river, a channel with a depth of 22 feet at mean low water and a width of 250 feet from Penrose Ferry Bridge to Fifty-eighth street, near Gibson Point, except at Yankee Point, where the width is 300 feet. From a point opposite Fifty-eighth street the channel has a width of 150 feet and a mean low-water depth of 20 feet to a point about one-fourth of a mile below the Baltimore and Philadelphia Railroad Bridge. Work is in progress at present with a view of obtaining a channel of the same dimensions from the latter point to a point 700 feet above Harrison's wharf, and from thence a channel 150 feet wide and 18 feet deep at mean low water up to the Walnut Street Bridge.

This improvement can be completed in accordance with the adopted project with funds now available.

During the fiscal year ending June 30, 1898, a survey of the river, made in accordance with the provisions of the river and harbor act of June 3, 1896, was completed from the mouth to Walnut Street Bridge, a distance of 7.39 miles, and a project for further improvement submitted on March 5, 1898. The project provides for the formation by dredging of a channel with a depth of 26 feet at mean low water and a bottom width of 400 feet from outside the bar to Penrose Ferry Bridge, 1½ miles, and thence a bottom width of 390 to 400 feet to Gibson Point, about 3 miles; from Gibson Point to Walnut Street Bridge, about 2.9 miles, for a channel 22 feet deep at mean low water and a bottom width varying from 320 to 400 feet. The total cost of the work was estimated at $3,153,000.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1898, revenue to the amount of $19,791,682.75. The nearest fort and light-houses are, respectively, Fort Mifflin and Schuylkill River range lights.

Money statement.

July 1, 1898, balance unexpended	$12,067.18
June 30, 1899, amount expended during fiscal year	967.18
July 1, 1899, balance unexpended	11,100.00

Appropriations.

Act of—		Act of—	
June 11, 1870	$15,000	August 2, 1882	$25,000
March 3, 1871	10,000	July 5, 1884	25,000
June 10, 1872	40,000	August 5, 1886	18,750
March 3, 1873	40,000	August 11, 1888	25,000
June 23, 1874	20,000	September 19, 1890	45,000
March 3, 1875	20,000	July 13, 1892	46,250
August 14, 1876	20,000	August 18, 1894	20,000
June 18, 1878	30,000	June 3, 1896	20,000
March 3, 1879	25,000		
June 14, 1880	40,000	Total	525,000
March 3, 1881	40,000		

Expenditures.

Total to June 30, 1899 .... $513,900

COMMERCIAL STATISTICS.

The following statement of the foreign and domestic commerce of the Schuylkill River for the years ending December 31, 1897 and 1898, has been compiled from returns made to this office by shippers, consignees, and carriers:

Vessel movement.

Class.	1897.		1898.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	353	743	227	669
Sailing vessels	547	191	301	268
Canal boats and barges	4,567	2,252	3,643	2,213
Total	5,467	3,186	4,171	3,150

Freight movement.

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Asphalt	19,912	$236,835	8,633	$57,155
Chemicals	10,591	64,439	12,696	66,289
Clay	2,570	3,103	1,145	1,923
Coal	508,094	1,733,136	396,073	1,148,039
Coal tar			15,964	319,280
Hay	1,538	7,726	1,540	9,242
Ice	85,129	135,888	96,989	201,028
Iron, manufactured			1,704	37,172
Iron ore	150,986	905,916	80,953	890,483
Lumber	2,533	19,205	8,049	76,708
Stone:				
Building	19,661	248,279	24,341	209,894
Paving	9,340	35,010	2,000	7,000
Sand	395,457	210,851	306,362	173,088
Wood, cord	15,322	75,257	21,441	70,329
Miscellaneous	50,242	4,744,488	19,694	3,571,956
Total	1,271,375	8,420,132	992,584	6,839,586
DEPARTING.				
Asphalt	600	27,643	656	22,960
Chemicals	1,651	46,388	1,117	28,932
Coal	86,171	273,184	159,736	394,447
Grain	517,290	7,547,000	665,700	11,000,000
Iron, manufactured			6,479	97,318
Manure	49,250	49,250	41,418	41,418
Oil cake			14,684	353,416
Petroleum and products	1,603,671	22,812,870	2,244,053	23,617,047
Miscellaneous	57,813	5,429,137	31,002	4,492,521
Total	2,316,446	36,185,472	3,164,845	40,048,059

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE PROGRESS MADE BY THE CITY OF PHILADELPHIA IN THE WORK OF IMPROVING SCHUYLKILL RIVER, PENNSYLVANIA, DURING THE FISCAL YEAR ENDING JUNE 30, 1899, WITH ONE INCLOSURE.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, June 22, 1899.

SIR: I beg to acknowledge the receipt of your communication under date of May 3, 1899, in which you ask to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1898, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

Under the head of the improvement of the Schuylkill River, I would report that under contract No. 3, for dredging between Penrose Ferry Bridge and Fifty-eighth street, which has been in force during the year, 98,518 cubic yards of material other than rock have been removed and placed beyond high water mark, and 8 cubic yards of rock. The work has been completed, and the total cost under that contract, which was $40,000, has been paid. The result is a channel 250 feet wide and 22 feet deep at mean low water, from a point about a half mile above Penrose Ferry Bridge to a point about one-quarter mile above Yankee Point.

Under contract No. 4, covering from Fifty-eighth street toward Walnut street, 88,708 cubic yards of other material and 697 cubic yards of rock have been removed, under which $32,741.39 have been paid. The final payment is still pending, the work under the contract has been completed, and in that portion there is a channel 150 feet wide and 20 feet deep at mean low water from Fifty-eighth street to near the Baltimore and Philadelphia Railroad Bridge. Ledge rock, which was found within the limits of the contract, was removed as far as the funds would permit.

Under contract No. 7, which was for dredging from the terminus of contract No. 3, near Yankee Point to Fifty-eighth street, and from a point below the Baltimore and Philadelphia Railroad Bridge to Walnut street, 168,575 cubic yards of other material were removed and 4 cubic yards of rock. The work has been completed, and the total cost, $35,000, has been paid. On this portion there is a channel 250 feet wide and 22 feet deep at mean low water.

Under contract No. 8, for work from below Fifty-eighth street, at the terminus of contract No. 7 to Fifty-eighth street, and from a point south of the Baltimore and Philadelphia Railroad Bridge toward Walnut street, work has been in progress, and 80,000 cubic yards of other material and 38 cubic yards of rock have been removed, which practically finishes the work of dredging below Walnut street. On a portion of this contract there is now a channel depth of 22 feet at mean low water, with a width of 250 feet. The work contemplates a channel of 150 feet width and 20 feet depth, from the neighborhood of the Baltimore and Philadelphia Railroad Bridge to a point 700 feet above Harrison's wharf, and from that point to Walnut street, a channel of 150 feet width and 18 feet depth at mean low water. For the statement of the details of these contracts and of the work done under them, I am indebted to Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, a copy of whose communication, marked "A," is herewith inclosed.

Yours, truly,

THEO. C. KNAUFF, *Secretary.*

Lieut. Col. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, June 7, 1899.

DEAR SIR: Replying to your letter requesting information upon the improvement of the channel of the Schuylkill River being carried on by the city of Philadelphia, I have to state that the following contracts have been in force and under execution during the year ending June 1, 1899:

Contract No. 3.—Dredging in the Schuylkill River between a point about half a mile above Penrose Ferry Bridge and Fifty-eighth street.

Authorized May 26, 1896; contractor, the Philadelphia Public Works Company; date of contract, September 7, 1896; limit of contract, $40,000.

Under this contract there have been removed and placed beyond high-water mark 98,518 cubic yards of material other than rock and 8 cubic yards of rock. The work has been completed at a total cost of $40,000. Final estimate paid February 6, 1899.

The completion of this contract resulted in the formation of a channel 250 feet wide and 22 feet deep at mean low water from a point about one-half mile above Penrose Ferry Bridge to a point about one-fourth mile above Yankee Point.

Contract No. 4.—Schuylkill River from Fifty-eighth street toward Walnut street.

Authorized December 28, 1895; contractor, the Philadelphia Public Works Company; date of contract, September 7, 1896; limit of contract, $45,000.

There have been removed and placed beyond high-water mark 88,708 cubic yards of material other than rock and 697 cubic yards of rock. There has been paid to date $32,741.39.

The whole of the channel dredging under this contract was completed in April. Final estimate is pending.

The completion of work under this contract resulted in the formation of a channel 150 feet wide and 20 feet deep at mean low water from Fifty-eighth street to a point about one-fourth of a mile below the Baltimore and Philadelphia Railroad Bridge. Considerable ledge rock was found within the limits of this contract, which was removed as far as the funds would permit.

Contract No. 7.—Dredging Schuylkill River from near Yankee Point, the terminus of contract No. 3, to Fifty-eighth street, and from a point south of Baltimore and Philadelphia Railroad Bridge to Walnut street.

Authorized January 7, 1898. Contractor, The International Contracting Company of Syracuse, N. Y. Date of contract, July 28, 1898. Limit of contract, $35,000.

Under this contract there were removed 168,575 cubic yards of material other than rock and 4 cubic yards of rock.

The work was completed January 16, 1899. Total cost, $35,000. Final estimate has been paid.

The work upon this contract resulted in the formation of a channel 250 feet wide and 22 feet deep at mean low water from a point about one-fourth of a mile above Yankee Point to a point about one-third of a mile below Fifty-eighth street.

Contract No. 8.—From a point about one third of a mile below Fifty-eighth street, the terminus of contract No. 7, to Fifty-eighth street, and from a point south of the Baltimore and Philadelphia Railroad Bridge toward Walnut street.

Authorized December 31, 1898. Contractor, American Dredging Company. Date of contract, March 7, 1899. Limit of contract, $45,000.

Work upon the contract is now in progress.

There have been removed and placed beyond high-water mark to date 80,000 cubic yards of loose material and 38 cubic yards of rock, which has practically completed the work of dredging below Fifty-eighth street.

It is probable that some rock will be encountered below the Baltimore and Philadelphia Railroad Bridge.

Work upon this contract to date has resulted in the formation of a channel 250 feet wide and 22 feet deep at mean low water from a point about one-third of a mile below Fifty-eighth street to Fifty-eighth street. The work now in progress upon the contract is with the view of obtaining a channel of 150 feet wide and 20 feet deep at mean low water from a point about one-fourth of a mile below the Baltimore and Philadelphia Railroad Bridge to a point 700 feet above Harrison's wharf and from that point to Walnut street, a channel 150 feet wide and 18 feet deep at mean low water.

The work which has been done has been within the lines of the project laid down by the Corps of Engineers, U. S. A., and has been carried on subject to the approval of the United States Engineer Officer in charge of this district.

Table of appropriations.

Date.	Description.	Amount.
Dec. 28, 1894	Allotment for removing impediments to navigation	$40,000
Dec. 28, 1895	Improvement Schuylkill River between Fifty-eighth and Walnut streets	50,000
May 26, 1896	Work between point above Penrose Ferry Bridge and Fifty-eighth street	40,000
Jan. 7, 1898	To continue the dredging	40,000
Dec. 31, 1898	do	50,000
	Total	220,000

Yours, truly,

G. S. WEBSTER, *Chief Engineer.*

Mr. THEO. C. KNAUFF,
Secretary, Board of Harbor Commissioners.

H 4.

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA.

An account of this improvement in contained in the Annual Report of the Chief of Engineers for 1896, page 918.

Since 1889 expenditures have been confined to maintenance and repairs. During the fiscal year ending June 30, 1898, two landing piers were repaired and a new mooring post placed, at a cost of $700, including inspection and superintendence. The funds now available are considered sufficient for all probable necessities.

This work is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1898, amounting to $19,791,682.75. The nearest fort and light-house are, respectively, Fort Mifflin and Cherry Island, rear.

Money statement.

July 1, 1898, balance unexpended	$1,715.72
July 1, 1899, balance unexpended	1,715.72

Appropriations.

Act of—		Act of—	
June 23, 1866	$5,000	August 5, 1886	$15,000
March 2, 1867	94,000	August 11, 1888	15,000
January 14, 1880	35,000	September 19, 1890	5,000
March 3, 1881	30,000		
August 2, 1882	15,000	Total	214,000

Expenditures.

Total to June 30, 1899	$212,284.28

H 5.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

An account of this work is contained in the Annual Report of the Chief of Engineers for 1896, page 920.

The river and harbor act of June 3, 1896, appropriated $7,660 for the maintenance and repair of this pier.

On September 11, 1896, a project for the application of the funds appropriated was submitted to the Department and approved September 18, 1896.

Under date of September 18, 1897, contract was entered into with William H. Virden, of Lewes, Del., for repairs to the pier in accordance with the adopted project approved September 18, 1896.

During the fiscal year ending June 30, 1898, the contract above referred to was completed, the following repairs having been made at a cost of $6,722.39, including inspection and superintendence: Forty-one fender piles were driven (40 on head of pier and 1 on the bridge); 42 fender piles shod with iron strips; 449 feet of wale on west side replaced by creosoted timber; 535 feet of wale on the east side, 720 feet of curbing, and the decking at the head of the pier replaced by new timber; a walk 3 feet wide laid on either side of the head of the pier and between the tracks for entire length of pier; the foot walk on the bridge repaired, and three supporting columns recovered and put back in place.

During the past fiscal year a storage platform 150 feet long and 15 feet wide was constructed near the head of the pier at a cost of $100.

It is proposed to hold the sum of $837.61, which remains available, for maintenance and repairs as needed.

The funds now available are considered sufficient for present needs.

This pier is in the collection district of Delaware, the nearest port of entry being Wilmington, where the amount of revenue collected during the year ending December 31, 1898, was $27,000. The nearest fort and light-house are, respectively, Fort Delaware and Delaware Breakwater Light.

Money statement.

July 1, 1898, balance unexpended	$937.61
June 30, 1899, amount expended during fiscal year	100.00
July 1, 1899, balance unexpended	837.61

Appropriations.

Act of—		Act of—	
July 15, 1870	$225,000	June 14, 1880	$10,000
June 23, 1874	10,000	March 3, 1881	10,000
March 3, 1875	25,000	August 2, 1882	13,000
March 3, 1875	'15,000	April 4, 1890	10,000
August 14, 1876	30,000	June 3, 1896	7,660
June 18, 1878	20,000		
March 3, 1879	10,500	Total	386,160

Expenditures.

Total to June 30, 1899	$385,322.39

H 6.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 922; 1897, page 1214, and 1898, page 1094.

During the past fiscal year a thorough examination has been made of the breakwater. The final report on the work was submitted June 19, 1899. A copy of this report is appended hereto.

From a survey of the Breakwater Harbor made in June, 1899, it appears that a decided scour has taken place in all parts of the harbor, the greatest scour being in rear of the old eastern breakwater. Over the protected anchorage site the average scour has amounted to 0.73 feet in the past year.

The commercial statistics of the harbor at and in the vicinity of this breakwater are given in connection with the report on the harbor of refuge, Delaware Bay, Delaware.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1898, was $27,000. Fort Delaware is the nearest fort and the Breakwater Light the nearest light-house.

Money statement.

July 1, 1898, balance unexpended	$9,710.11
June 30, 1899, amount expended during fiscal year	8,640.37
July 1, 1899, balance unexpended	1,069.74

Appropriations.

Act of—		Act of—	
May 7, 1822	$22,700.00	June 23, 1866	$107,910.00
May 23, 1828	250,000.00	March 2, 1867	109,493.70
April 23, 1830	162,000.00	August 2, 1882	125,000.00
March 2, 1831	208,000.00	July 5, 1884	75,000.00
July 3, 1832	270,000.00	August 5, 1886	56,250.00
March 3, 1833	270,000.00	August 11, 1888	100,000.00
June 28, 1834	270,000.00	September 19, 1890	80,000.00
March 3, 1835	100,000.00	July 13, 1892	50,000.00
July 2, 1836	100,000.00	August 18, 1894	50,000.00
July 4, 1836 (survey)	1,000.00	June 3, 1896	80,000.00
March 3, 1837	141,000.00		
July 7, 1838	150,000.00	Total	2,808,353.70
August 30, 1852	30,000.00		

Total amount appropriated under present project to June 30, 1899..... $616,250.00

Expenditures.

Total to June 30, 1899	$2,807,283.96
Total under present project to June 30, 1899	615,180.26

COMMERCIAL STATISTICS.

During the year ending December 31, 1898, the following vessels called at Delaware Breakwater for the reasons given:

	Steamers.	Ships.	Barks.	Brigs.	Schooners.	Barges.	Total.
For orders	179	23	27	2	13		244
For harbor	75	8	27	5	1,099	355	1,569
In distress					2		2
Quarantined							
Total	254	31	54	7	1,114	355	1,815

In addition to the above about 2,000 craft under 30 tons have used the breakwater for harborage.

FINAL REPORT OF LIEUT. COL. C. W. RAYMOND, CORPS OF ENGINEERS, UPON THE IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., June 19, 1899.

GENERAL: I have the honor to submit the following final report upon the improvement of Delaware Breakwater, Delaware. As stated in the Annual Report for 1898, the work of construction under the project for this improvement was completed during the last fiscal year, but it was considered desirable to make a thorough examination of the structure before the submission of the final report. This examination was completed during the present fiscal year.

The original Delaware Breakwater harbor was formed by two detached breakwaters, separated by an interval of 1,350 feet, which were commenced in 1828 and completed in 1869. The project recently completed provided for the construction of a new work to close the interval between these breakwaters. It was first proposed by a board of engineers in a report dated August 29, 1872. It was again recommended by a board of engineers in a report dated February 8, 1879. The board of 1879 estimated the cost of the work at $600,000. The depth of water over this interval was about 34 feet at mean low water. The locations of these breakwaters are shown on the map transmitted herewith. In the Annual Report of the Chief of Engineers for 1882, page 792, a project was submitted for the execution of the work. It was proposed to close the gap by means of a concrete superstructure resting upon a random stone foundation. A bridge of creosoted timber carrying a double railroad track was to be constructed completely across the interval. The substructure was to be formed by depositing the materials from this bridge to the level of 12 feet below low water and with a top width of 48 feet and slopes of 1 on 2. To construct the concrete superstructure, the bays of the bridge were to be inclosed with detachable aprons forming boxes in which the concrete was to be deposited. The blocks forming the superstructure were to have a length of 16 feet, a bottom width of 24 feet, a top width of 12 feet, and a height of 24 feet. Their bases were to be formed 12 feet below low water. The estimated cost of the work, including plant, was $675,000.

The sum of $125,000 was appropriated in the river and harbor act of August 2, 1882, for prosecuting the work, but active operations were not commenced until 1884. In the meantime, on June 4, 1884, the project was modified by authority of the Chief of Engineers.

The approved project under which work was commenced provided for the abandonment of the proposed bridge. A foundation of brush mattresses was to be laid across the gap and ballasted with stones weighing from 50 to 150 pounds each. The stone for the substructure was to be deposited from vessels to a height of 12 feet below mean low water. Forms for the concrete blocks for the construction of the superstructure were to be made of creosoted timber at both sides of the gap, launched into position and held by weights until filled with concrete, the work being gradually extended from both ends toward the center until the gap was closed. The estimated cost of this project was $675,000.

The construction of the mattress foundation was commenced in 1884 and completed during the following year. From this time until September 27, 1889, the operations consisted in depositing stone upon this foundation for the formation of the substructure, the total quantity deposited under this project being 101,713 gross tons. Thetotal amount expended upon this work was $355,022.22.

On February 20, 1890, a new project for the completion of the work was approved by the Department. This project provided for the completion of the random stone substructure, with a sea slope of 1 on 2 and a harbor slope of 1 on 1⅓, the top to be 62 feet wide and 15 feet below mean low water. The concrete superstructure was to be 27 feet high and 27 feet wide, and its top was to be 7½ feet above mean high water. It was to be built of sloping concrete blocks to a level of about 2 feet above high water, and the remaining 5½ feet of height was to be formed of concrete in mass. The estimated cost of completing the work was $500,000, making the total estimated cost of the project about $855,000.

In 1890 a careful survey was made of the stone already deposited for the formation of the substructure and the data thus obtained led to the formation of a new project for the completion of the work. This project was approved on April 4, 1891. It provided for raising the substructure to the level of mean low water, with a top width of 40 feet at that level and such slopes as might be formed by the action of the sea, by depositing random stone within the limits of the assumed low-water width. The superstructure above low water was to be 14 feet high and 20 feet wide at top, with slopes of about 1 on 0.7 formed by heavy stones laid as headers, the interior space to be filled with rubble. These slopes were to be laid up roughly in high steps in order to break the continuity of the waves. The estimated cost of thus completing the work was $400,000, making the total estimated cost of the project $756,250.

Under this revised project the work of depositing stone for the completion of the substructure was commenced on July 28, 1891. As the stone already deposited had raised the average level of the work too high for the advantageous employment of bottom-dumping barges, all the material was deposited from steam-derrick deck barges moored in position perpendicular to the axis of the work. Each stone was raised by the derrick and dropped into the place indicated by the Government inspector. The work was commenced at the eastern end of the western breakwater and carried continuously to the eastward across the interval.

In November, 1891, when operations were suspended for the winter season, the structure had been raised to low water over a distance of 603 feet. This portion of the work was exposed to violent storms before the resumption of operations in the following spring. On June 1, 1892, the structure had been raised to low water over a distance of 1,006 feet, 34,022 tons of stone having been deposited. The average cross section of the work at that time is shown in fig. 2. The average slopes of the portions built before and after the winter were found to be practically the same.

During the fiscal year ending June 30, 1893, the structure was raised to low water over the whole interval. The amount of stone deposited was 18,746 tons. The sections of the work were not determined owing to lack of funds but the slopes appeared to have suffered little change. The previous winter had been unusually severe but the work was not injured. It had settled about 1 foot. The average cross section as determined in December, 1893, is shown on fig. 3.

Owing to lack of funds, no work was done during the fiscal year ending June 30, 1894. During the fiscal year ending June 30, 1895, 601 tons of stone were deposited to fill cavities in the surface and slopes of the structure. During the fiscal year ending June 30, 1896, the superstructure was fully completed for a distance of 243 feet and partly constructed for a farther distance of 269 feet. The amount of stone deposited was 8,016 tons. At the end of the fiscal year ending June 30, 1897, the superstructure had been fully completed for a distance of 464 feet and partly constructed for a farther distance of 46 feet. The amount of stone deposited during the year was 17,078 tons. During the fiscal year ending June 30, 1898, the superstructure was completed. The amount of stone deposited during the year was 26,927 tons.

The work was completed under this revised project on June 30, 1898, 105,390 tons of stone having been placed in position from 1891 to 1898. The total amount of stone in the work is 207,103 tons. The total cost of the work, including surveys and examinations, before and after completion, was $615,036.02.

The plans at first adopted for this work provided for a concrete superstructure resting upon a low random stone substructure, these methods being considered much less expensive than a stone superstructure resting upon a random stone substructure raised to the level of low water. This conclusion was based upon two assumptions: (1) that 1.5 gross tons of stone are required for every cubic yard of volume in the work, and (2) that the slopes of the old breakwater were slopes of equilibrium resulting from wave action, and that therefore it would not be safe to assume a cross section for the new substructure having a less area than that of the substructure of the old breakwater.

The first assumption was based upon a comparison of the volumes of the old breakwaters with the weights of the stone deposited for their construction. The results of the measurements of 1890, and other considerations, however, led to the belief that 1.25 tons per cubic yard was an ample allowance, including settlement and loss beyond calculated slopes.

After a careful study of the history of the old work, the second assumption was also found to be open to serious question. The form and dimensions of the old breakwater were principally based upon a study of the long flat slopes of the Cherbourg breakwater, at that time the only practical example of an extensive random stone offshore breakwater. The stone was not deposited to the best advantage, as the methods of unloading then available were not such as to render an accurate emplacement possible. It was concluded that, while the slopes of the old work were doubtless determined by wave action, the cross-sectional area was probably the result, not only of this action, but also of the location of the stone when originally deposited, and it therefore seemed probable that a less amount of material differently deposited might be found to have the necessary stability.

The project of 1891, under which the work was completed, was based upon these conclusions. The methods employed involve some new ideas in random stone breakwater construction, and as these ideas have been adopted to some extent in the plans for extensive works of a similar character—notably at Sandy Bay, Massachusetts, San Pedro, Cal., and the new work in Delaware Bay—it seemed desirable to indicate in this final report how far they have been confirmed by experience and in what respects they may require modification.

At the time this project was adopted the random stone substructure had been raised along its axis to an average level of about 15 feet below low water, the material having been deposited without any attempt at arrangement as regards the size of the stones. The average section of this work is indicated by the shaded line on fig. 1. The fundamental principle adopted in the new project for the completion of the substructure was to deposit all the materials within the assumed limits of the low-water width and permit the mass to assume its slopes under the action of the sea. The larger stones were to be deposited on the sea side and the smaller stones on the harbor side of the work. The slopes assumed for the purpose of estimating quantities were adopted from the cross section of the old breakwater and are shown on fig. 1.

The inner and outer walls of the superstructure were to be formed of very heavy stones laid endwise to the sea, the interior space to be compactly filled with rubble.

The characteristic advantages of random stone breakwaters, as compared with breakwaters of other types, are the facility and simplicity of their construction and repair. Their peculiar disadvantage is that they require a large volume of material in the substructure, most of which is not needed to resist the action of the sea and serves only to support the comparatively small resisting parts of the work. Accordingly it is desirable to confine the volume of the substructure to the smallest limits consistent with permanency and stability, and the project was prepared with this end in view.

The volume of the substructure depends upon the width of the superstructure at its base, the inclinations of the sea and harbor slopes, and the depth of water over the site. To reduce the superstructure to the least dimensions consistent with stability, it was to be built compactly of large stones presenting their smallest dimensions to the action of the sea, which, with modern facilities, can be readily done above low water. In preparing the project the following assumptions were made, subject to modification if found desirable during the progress of the work:

1. *The superstructure.*—The height was assumed at 14 feet above mean low water or 9.5 feet above high water. The old breakwaters are somewhat lower than this, but experience shows that they are too low, as waves sometimes pass over them and disturb the anchorage.

The top width was assumed at 20 feet. This is about the top width the old breakwaters would have if raised to the level of the new one with existing slopes.

The slopes were assumed at about 1 on 0.7. This slope is much steeper than has usually been adopted on the sea side of a breakwater. There are, however, on one of the old breakwaters several sections where this exterior slope exists and has stood well for many years. The saving of material resulting from the adoption of such a slope is, of course, very great. and it was therefore decided to commence the superstructure by building a small length with this inclination and thus determine experimentally whether it had the requisite stability.

The above dimensions and slopes correspond to a bottom width of about 40 feet. This is also the top width of the substructure.

2. *Formation of steepest slopes for the substructure.*—The condition that all material should be deposited within the limits of the low-water width was established in order to insure the deposit of every stone inside the stable slopes of maximum declivity. The declivities of the slopes toward the sea were presumed to be largely dependent upon the size of the materials used in their construction, since they are exposed to wave action. The harbor slope was supposed to be practically independent of the size of the materials, since it is exposed to very little action from the sea. This view was confirmed by a careful study of the harbor slopes of existing works of a similar character. Accordingly the larger stones were to be deposited on the sea side and the smaller stones on the harbor side of the work.

The exposed slopes of the substructure were based upon the existing slopes of the old eastern breakwater, although those of the old western breakwater (generally known as the "ice breaker") are much steeper. This was done because the old eastern breakwater is much more exposed to the action of the sea than the ice breaker; and as it was impossible to determine how much the difference in slopes was due to difference of exposure and how much to differences in methods of construction it was thought best to assume the gentler slopes for the purpose of estimating quantities, especially as the exposure of the new work is nearly twice that of the old eastern breakwater.

3. *Harbor slope of the substructure.*—This slope was assumed at 1 on 1.3, this being about the average inclination of the harbor slopes of both the old breakwaters.

4. *Plane of rest.*—This is the horizontal plane below which the action of the sea is assumed to be so small that it may be neglected. From a study of the cross sections of the old eastern breakwater this was assumed at 12 feet below mean low water.

5. *Lower sea slope of the substructure.*—This is the slope below the plane of rest. It was assumed at 1 on 1.5, which is the inclination of this slope in the old eastern breakwater.

6. *Upper sea slope of the substructure.*—This is the slope between the plane of rest and the foot of the superstructure. It was assumed at 1 on 3, which is the inclination of this slope in the old eastern breakwater.

It may be of interest to note that after the first year's experience in the construction of this work, the Board of Engineers upon the deep water harbor in Southern California in its design for a breakwater at San Pedro Bay, gave this slope an inclination of 1 on 2, which is the exterior slope of the ice breaker. (See Report of Board, dated October 27, 1892; Ex. Doc. No. 41, House of Representatives, Fifty-second Congress, second session.)

7. *Estimate of quantities.*—From careful measurements of the material deposited in the new work previous to 1889, it was determined that each cubic yard of enrockment required 1.17 gross tons of stone. For the purpose of estimating, this was increased to 1.25 tons per cubic yard to allow for settlement and loss of stone outside the assumed slopes. The original estimate for the work done since 1891 was 106,000 gross tons.

The average cross section of the work after completion, as determined by recent measurements, is shown on fig. 4. In determining the average cross section of the substructure the sections measured within about 150 feet of the ends of the work were not employed, because the slopes in these localities were strengthened by the deposit of additional stone on account of local conditions. This was necessary in joining the new to the old works, especially at the eastern end where there is a re-entrant angle. The form and general character of the superstructure are shown by the two photographs transmitted herewith.

The following comparison between the original assumptions and the results of experience may be of some interest and value, although all the conclusions are not as definite as is desirable, owing to the fact that a large part of the substructure was deposited before the new method of construction was adopted:

1. *The superstructure.*—The height, which is 9.5 feet above high water, seems to be about right for this locality. In storms the top of the wave frequently passes entirely over the work, but does not create troublesome disturbance in the harbor. It does not seem desirable to build the superstructure so high that it will be compelled to absorb the accumulated energy of the entire wave. The top width of 20 feet is certainly large enough, and probably a width of 15 feet would have given ample stability. The slopes of the superstructure appear to have maintained perfect stability, although the work has been severely tested by violent storms. The theoretical objection to the steep exterior slope is that it intensifies the action of the returning wave, and thus causes a displacement of the material of the substructure just below low water at the foot of the outer wall. The outer surface of the wall is, however, so irregular that the wave is broken up before its return. In a few places stones have been occasionally displaced at the top of the substructure by this return action, but the tendency to motion was easily checked by the deposit of a few large stones.

2. *Formation of steepest slopes for the substructure.*—The slopes of the substructure have slowly changed during the progress of the work, as

shown by comparing figs. 2, 3, and 4. Although the completed structure has been exposed to the action of the sea for about one year, and most of the substructure for several years, it is too soon to decide that permanent inclinations have been attained. The sea slope is steeper and the harbor slope less steep than was expected. This is probably the result of placing the larger stones on the exterior and the smaller stones on the interior of the work. The assumption that the harbor slope is practically independent of the size of the materials of which it is constructed seems to be erroneous.

With the best modern appliances there is no difficulty in transporting and depositing very large stones, and stones weighing from 4 to 15 tons can now be obtained and deposited at as low a price as the smaller ones. It seems probable that better results would be obtained if both slopes were formed by the deposit of very large stones, the smaller stones being all placed in the interior of the work. If this method were adopted it would probably be found desirable to deposit a part of this material outside the limiting lines of the low-water width.

3. *Harbor slope of the substructure.*—The average inclination of this slope is about 1 on 1.4, instead of 1 on 1.3, as was expected.

4. *Plane of rest.*—There is no indication of the existence of a plane of rest either in this work or in the ice breaker. It seems probable that the change of slope, which apparently indicates a plane of rest in the old eastern breakwater, is the result of the method of construction and not of the action of the sea. If the stone is so deposited as to assume an exterior form, due to the action of natural forces only, it is believed that a single slope will be found to extend from low water to the bottom.

5. *Lower sea slope.*—There has been considerable shoaling on the outside of the work, and the material deposited before 1889 is now covered with sand so that the slope can not be measured.

6. *Upper sea slope.*—During the progress of the work it was considered desirable, as a matter of precaution, to deposit large stones along the foot of the superstructure. The material of the substructure on the seaside therefore rises to a level about 2.5 feet above low water. The average surface below low water (shown on fig. 4) has two slightly different inclinations. From low water to 6.7 feet below low water the slope is 1 on 1.5, and from 6.7 feet below low water to 15.4 feet below low water the slope is 1 on 1.2. Below this level the slope is believed to have been formed by material deposited before 1889. It is evident that the point of change below low water is too high to indicate the existence of a plane of rest. On the contrary, it seems probable that the surface has not yet assumed a slope of stability, and that it will, in the course of time, settle down to a uniform slope of about 1 on 1.5. The deposit of some additional stone at the foot of the superstructure to conform to this movement may perhaps be necessary. This slope is much steeper than was expected, as it was inferred from the examination of other works that the steepest slope of stability would be found to be about 1 on 2.

7. *Estimates of quantities.*—As before stated, it was assumed as the result of measurements made in 1891 that each cubic yard of the work would require 1.17 gross tons of stone, which estimate was increased to 1.25 tons per cubic yard to allow for settlement and misplacement. Measurements since the completion of the work show that the weight of the material deposited since 1891 was 1.203 tons per cubic yard. The average weight for the whole work built since 1884 was 1.188 tons per cubic yard. The weight of the stone averaged about 165 pounds

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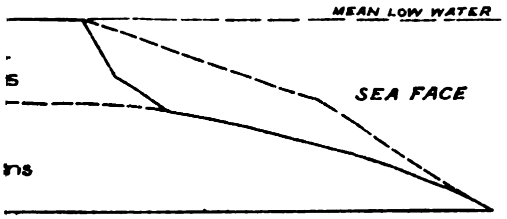

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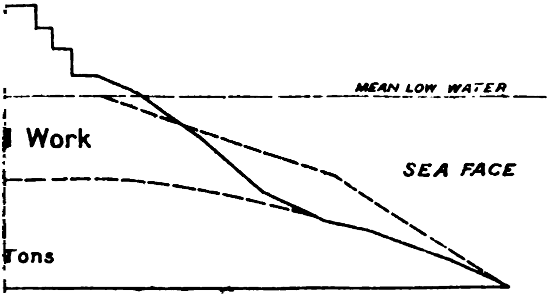

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Engineer Office, U. S. Army
Philadelphia, Pa.
ompany final report dated June 19, 1899.

C. W. Raymond

Lieut. Colonel, Corps of Engineers.

Guggenheimer, Weil & Co. Photo.-Litho. Baltimore.

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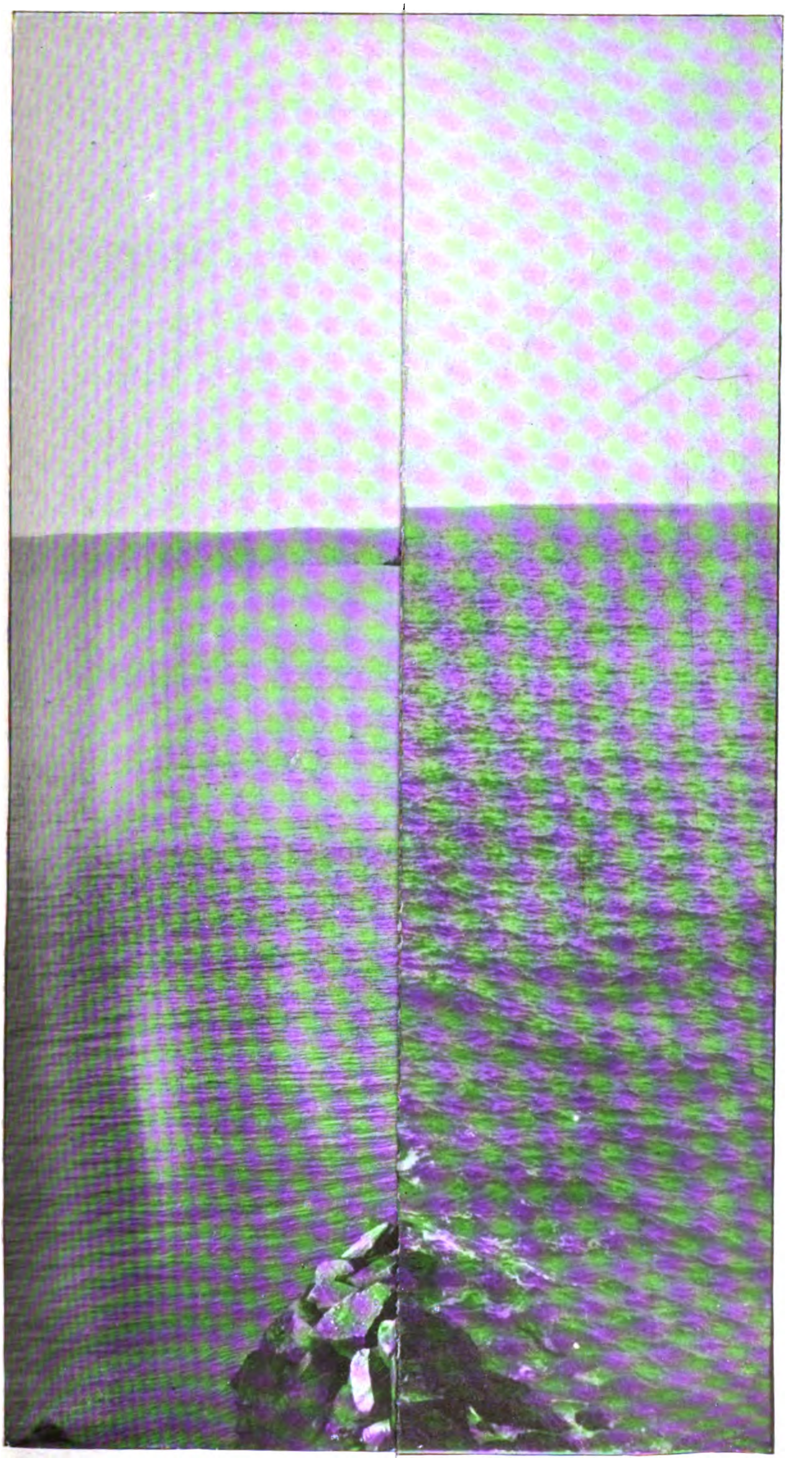

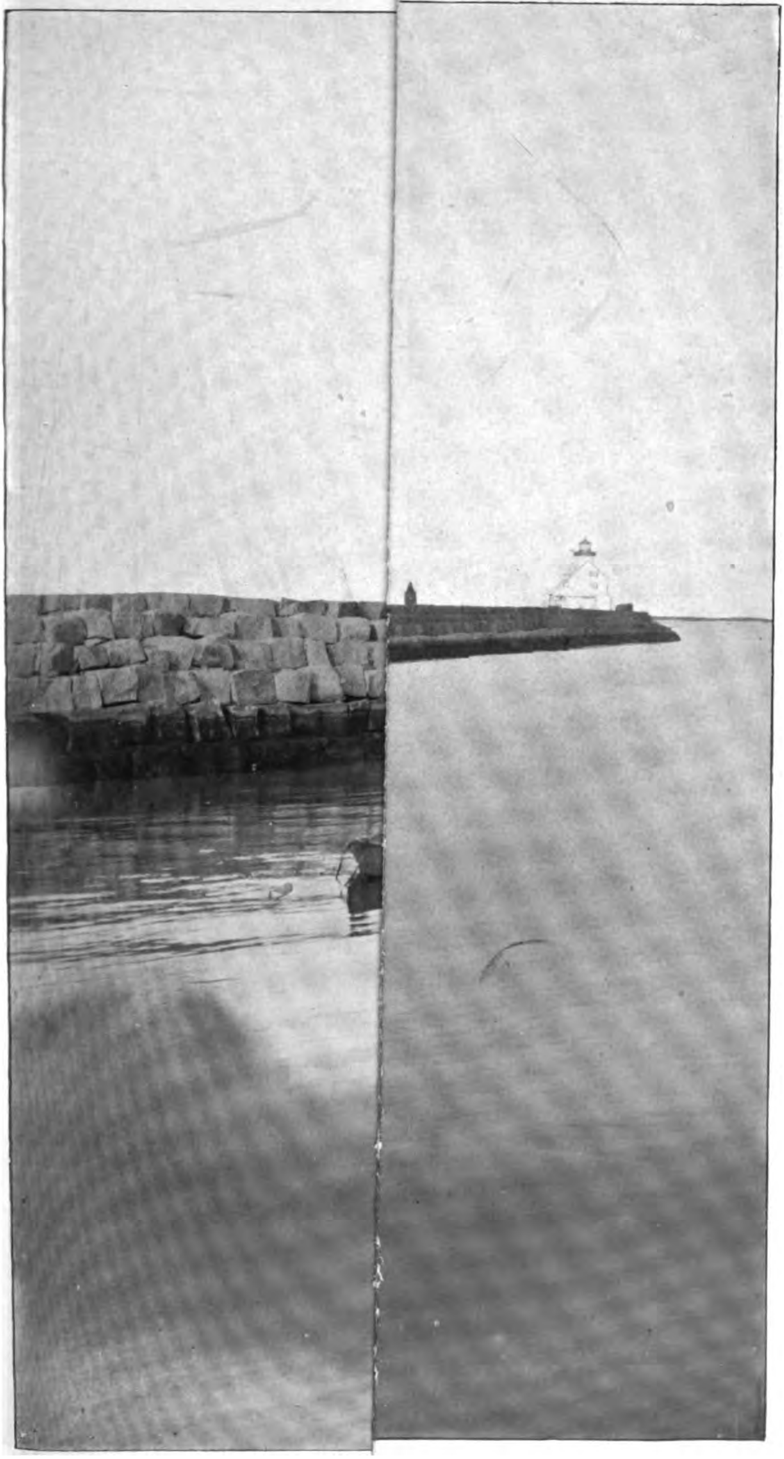

per cubic foot. The voids are therefore about 40 per cent of the whole volume. The stones were of all sizes, the largest weighing about 13 tons.

The estimate of material for the work done since 1891 was 106,000 tons. The amount of stone actually deposited was 105,390 tons.

The experience obtained in the construction of this little work will, I trust, be found of some value in connection with breakwater construction on a larger scale, although the conclusions to be derived from it are necessarily incomplete. A large part of the substructure was constructed before the new method was adopted; the work was prosecuted slowly on account of lack of funds, and the best appliances for its execution were not always employed.

The most economical and rapid method of raising the substructure to a level of about 10 feet below low water is undoubtedly by depositing the material from bottom-dumping barges. The experience in this work furnishes no information with reference to this method as conducted with the best modern appliances. The points that seem to be best established are that the superstructure can be safely made of much smaller dimensions and with a much steeper sea slope than have heretofore been considered admissible, and that the exterior slope of the substructure has sufficient stability with an inclination of about 1 on 1.5 if the stones forming it are large and properly deposited.

In the extensive new breakwater now under construction in Delaware Bay more complete and satisfactory information will doubtless be obtained. The experience already gained from this new work can not properly be fully described in this report, but it may be well to mention two points which may be of use to others. It is found of great advantage to temporarily raise the substructure to about the height of high water over the outer half of its low-water width. This forms a shelter for the stone vessels, and, by weighting the exterior of the work, tends to to bring the sea surface sooner to a slope of stability. During the first winter following deposit the mass settles at least one foot. The action of storms moves the stones heaped up in front over toward the rear, depositing them in the depression caused by settlement. This reduces the amount of leveling required for the establishment of the superstructure. It is also found best to level the substructure at about 1 foot above low water instead of at low water. This greatly expedites and facilitates the construction of the superstructure, and when the work has settled to its final position the foot of the wall will be found at about the level of low water.

For many years previous to its completion the Delaware Breakwater Harbor was continually shoaling, and it is now of use only for vessels of small draft. Its present condition is shown by the map accompanying this report. It is a matter of great interest to determine the influence of closing the interval between the old breakwaters upon the rate of shoaling in the harbor, since engineers of recognized ability have widely differed with reference to this question. Since the structure was raised above high water the strength of the ebb currents running parallel to the general direction of the breakwaters, and therefore the tendency to scour, have greatly increased.

The following information is derived from a study of the surveys of 1863, 1881, 1891, 1898, and 1899. For the purpose of comparison, an area of about 270 acres in rear of the breakwaters is divided into four compartments, marked "A," "B," "C," "D," on the accompanying map.

The annual rates of change in depth in the harbor and its compartments during the periods considered are shown in the following table, in which + indicates shoaling and — scouring.

Period.	Condition of work.	Average depth of annual change.				Average annual change over western half of harbor, ½ (A + B).	Average annual change over eastern half of harbor, ½ (C + D).	Average annual change over harbor.
		A.	B.	C.	D.			
		Feet.	*Feet.*	*Feet.*	*Feet.*			
1863-1881	Before commencement of new work..........	+0.03	+0.07	+0.16	+0.18	+0.05	+0.17	+0.11
1881-1891	Structure raised to 15 feet below mean low water.................	+ .23	+ .17	+ .19	+ .14	+ .20	+ .17	+ .18
1891-1898	Work completed...... .	+ .74	+ .37	+ .10	+ .13	+ .56	+ .11	+ .34
1898-1899	One year after completion.................	— .10	— .30	—2.10	— .40	— .20	—1.25	— .73

It appears from this table that the work during its progress increased the rate of shoaling in the western part of the harbor and diminished it in the eastern part. Since the completion of the work there has been a decided scour in all parts of the harbor, the greatest scour being in rear of the old eastern breakwater. The work has not been completed long enough to permit of definite conclusions as to final results, but there is reason to hope that the deterioration in depth, which was so long in progress, has finally been checked. The harbor is so useful for small vessels that the cost of its completion seems to have been amply justified.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

H 7.

CONSTRUCTION OF HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1897, page 1216.

During the fiscal year ending June 30, 1898, under a contract with Messrs. Hughes Bros. & Bangs dated February 5, 1897, 289,709 tons of stone were deposited in the work, the total amount deposited to June 30, 1898, being 298,744 tons.

During the past fiscal year, under the same contract, 450,460 tons of stone were deposited in the work, the total amount deposited to June 30, 1899, being 749,204 tons.

The contract above referred to provides for the complete execution of the work to be paid for as appropriations may from time to time be made by law. It required the placing of 125,000 tons of stone during the year ending December 31, 1897, as estimated by the engineer officer in charge, under the terms of the contract; and for the continuance of the work as rapidly as may be required by the engineer officer in charge, to the extent of placing 280,000 tons during any one calendar year, provided sufficient funds are available for payment therefor. The work is

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required to be commenced on or before May 1, 1897, and to be completed on or before December 31, 1901, unless prevented by lack of funds.

On December 31, 1897, 131,106 tons of stone had been deposited in accordance with the terms of the contract.

The condition of the work June 30, 1899, was as follows:

Beginning at the stake light, which was erected May 4, 1897, to mark the initial point of the upper part of the work, and running S. SE. ⅞ E. for a distance of 5,280 feet and thence S. by E. a further distance of 1,450 feet, making a total length of 6,730 feet, the substructure had been brought to a width of about 41 feet at mean low water; thence for a further distance of 600 feet it was partly constructed to an average height of about 10 feet below mean low water. The superstructure had been completed for a distance of 350 feet and partly constructed for a further distance of 1,350 feet. The construction of the superstructure was begun at a point 1,000 feet distant from the stake light.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1898, was $27,000. Fort Delaware is the nearest fort, and the Breakwater Light the nearest light-house.

Money statement.

July 1, 1898, balance unexpended		$917, 788. 25
Amount appropriated by sundry civil act approved March 3, 1899		377, 000. 00
		1, 294, 788. 25
June 30, 1899, amount expended during fiscal year		540, 607. 09
July 1, 1899, balance unexpended		754, 181. 16
July 1, 1899, outstanding liabilities	$159, 018. 46	
July 1, 1899, amount covered by uncompleted contracts	595, 162. 70	
		754, 181. 16
Amount (estimated) required for completion of existing project		773, 666. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901		450, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

Act of—	
June 3, 1896	$5, 000
June 4, 1897	394, 334
July 1, 1898	800, 000
March 3, 1899	377, 000
Total	1, 576, 334

Expenditures.

Total to June 30, 1899	$822, 152. 84

CONTRACT IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With Hughes Bros. & Bangs, of Syracuse, N. Y., dated February 5, and approved February 20, 1897, for complete execution of the work of constructing a stone breakwater, to be paid for as appropriations may be made from time to time by law. To be commenced on or before May 1, 1897, and completed on or before December 31, 1901, unless prevented by lack of funds.

H 8.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 925.

The original project, adopted in 1881, provided for the improvement of the main river and the Mount Holly Branch and contemplated no improvement in the Lumberton Branch. The river and harbor act of June 3, 1896, appropriated $2,000 for continuing this improvement, this sum to be expended in the improvement of the Lumberton Branch.

The Lumberton Branch was surveyed as far as Lumberton, N. J., in 1897, and a project for its improvement approved July 3, 1897.

The project provided for the formation, by dredging, of a channel 6 feet deep at mean low water and 30 feet wide through the shoals at Patterson's landing and below and above Paxson's landing as far as available funds would permit.

Under date of September 11, 1897, contract was entered into with Frank C. Somers, of Camden, N. J., for the dredging required by the project.

Work under this contract was commenced October 19, 1897, and completed November 5, 1897, 5,026 cubic yards having been dredged at a cost of $1,767.59, including inspection and superintendence. The cost of the survey of the Lumberton Branch, made during the fiscal year ending June 30, 1897, was $232.41.

By the work done a channel 30 feet wide and 6 to 7 feet deep at mean low water was formed through the shoals at Patterson's landing and below Paxson's landing and partly formed through the shoal above Paxson's landing, the total lengths of channel aggregating 1,675 feet, thereby completing the work provided for in the project.

The river and harbor act of March 3, 1899, appropriated $2,000 for continuing this improvement, this sum to be expended in the improvement of the Lumberton Branch.

A project for the expenditure of this sum was approved April 8, 1899.

The project provides for the formation by dredging of a channel 30 feet wide and 6 feet deep at mean low water through the shoals below Moore's landing and below Hainesport, as far as available funds will permit.

Under date of June 22, 1899, contract was entered into with John L. Mills, of Camden, N. J., for the dredging required by the project. Work under this contract will be commenced during the present season.

This work is situated in the collection district of Burlington, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1898. The nearest fort is Fort Mifflin, and the Horseshoe lights are the nearest light-houses.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$2,000.00
June 30, 1899, amount expended during fiscal year..........................	20.33
July 1, 1899, balance unexpended	1,979.67
July 1, 1899, amount covered by uncompleted contracts......................	1,700.00
July 1, 1899, balance available	279.67

Appropriations.

BELOW THE FORKS.

Act of—		
March 3, 1881		$10,000.00
August 2, 1882		10,000.00
September 19, 1890		10,000.00
		30,000.00

MOUNT HOLLY BRANCH.

Act of—		
July 13, 1892	$5,000.00	
August 18, 1894	3,000.00	
		8,000.00

LUMBERTON BRANCH.

Act of—		
June 3, 1896	2,000.00	
March 3, 1899	2,000.00	
		4,000.00
Total		42,000.00

Expenditures.

Total to June 30, 1899	$39,520.54
Carried to the surplus fund in July, 1890	100.09
Redeposited to credit of appropriation December 21, 1895	399.70

Abstract of proposals for excavating and removing material from Rancocas River, New Jersey, opened June 8, 1899, by Lieut. Col. C. W. Raymond, Corps of Engineers.

[Approximate quantity of material to be removed, 6,800 cubic yards.]

No.	Name and address of bidder.	Per cubic yard.	Amount.
		Cents.	
1	American Dredging Co., Philadelphia, Pa	30	$2,040.00
2	River and Harbor Improvement Co., Camden, N. J	28	1,904.00
3	John L. Mills, Camden, N. J	25	1,700.00
4	Delaware Construction Co., Wilmington, Del	35	2,380.00
5	Philadelphia Construction Co., Philadelphia, Pa	30	2,040.00

Contract (dated June 22, 1899) entered into with John L. Mills. In progress.

LIST OF ALL CONTRACTS IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With John L. Mills, of Camden, N. J., for dredging in the Lumberton Branch of the Rancocas River, dated June 23, and approved July 7, 1899. Work to be commenced on or before July 10, 1899, and completed on or before September 10, 1899.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1897 and 1898.

Kind of vessel.	Arrivals.				Departures.			
	1897.		1898.		1897.		1898.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	308	65,400	896	143,600	308	65,400	896	143,600
Sailing vessels	150	7.250	155	7,600	150	7,250	155	7,600
Barges and canal boats	2,437	609,250	1,687	421,750	2,437	609,250	1,687	421,750
Total	2,895	681,900	2,738	572,950	2,895	681,900	2,783	572,950

Freight statement.

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Chemicals	6,500	$43,200	3,300	$23,800
Coal	34,000	97,000	35,000	125,000
Fertilizers	....	....	3,000	16,500
Iron, pig	4,400	48,400	4,100	53,300
Lime	10,000	20,000	10,000	18,000
Manure	75,000	112,500	78,000	97,000
Miscellaneous	6,500	267,450	6,480	287,300
Total	136,400	588,550	139,880	620,900
DEPARTING.				
Fish	....	....	200	16,000
Sand	206,400	277,300	150,300	150,000
Produce	6,500	325,000	5,620	595,000
Miscellaneous	5,700	263,500	5,780	282,500
Total	218,600	865,800	161,900	1,043,500

H 9.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 928.

Under date of March 16, 1897, contract was entered into with John L. Grim, of Philadelphia, Pa., for the construction of about 400 linear feet of pile dike and the dredging of about 7,500 cubic yards of material, scow measurement, from the channel of the creek above Upper Hancock Bridge.

During the fiscal year ending June 30, 1898, work was in progress under the above-mentioned contract, which was completed in September, 1897. Under this contract 404 linear feet of dike were constructed during the fiscal year ending June 30, 1897, and 4,269 cubic yards of material were removed, at a total cost, including inspection and superintendence, of $2,640.50. About three-fifths of the projected work had been accomplished.

The river and harbor act of March 3, 1899, appropriated $3,000 for continuing the improvement. A project for the expenditure of this sum was approved April 8, 1899. The project provides for enlarging, by dredging, existing channels at the shoals below Upper Hancock Bridge, viz: at Lower Bradways, Smith Reeves, and below the Square, to a width of 75 feet and depth of 6 feet at mean low water, and above Upper Hancock Bridge, for the formation of a channel by dredging, 60 feet wide and 6 feet deep at mean low water through the shoals at Upper Bradways, below Robinsons Landing, above Robinsons Landing, Lower Fowsers, Upper Fowsers, Lower Lamberts, Upper Lamberts, and at Quinton, as far as available funds will permit.

Under date of June 22, 1899, contract was entered into with the River and Harbor Improvement Company, of Camden, N. J., for the work required by the project.

Work under this contract will be commenced during the present season.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1898. The nearest fort is Fort Delaware, and the Reedy Island Light is the nearest light-house.

Money statement.

July 1, 1898, balance unexpended	$352.55
Amount appropriated by river and harbor act approved March 3, 1899	3,000.00
	3,352.55
June 30, 1899, amount expended during fiscal year	330.66
July 1, 1899, balance unexpended	3,021.89
July 1, 1899, amount covered by uncompleted contracts	2,475.00
July 1, 1899, balance available	546.89
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

Act of—	
September 19, 1890	$6,000
July 13, 1892	3,000
August 18, 1894	3,000
June 3, 1896	3,000
March 3, 1899	3,000
Total	18,000

Expenditures.

Total to June 30, 1899	$14,978.11

Abstract of proposals for excavating and removing material from Alloway Creek, New Jersey, opened June 8, 1899, by Lieut. Col. C. W. Raymond, Corps of Engineers.

[Approximate quantity of material to be removed, 16,500 cubic yards.]

No.	Name and address of bidder.	Per cubic yard.	Amount.
		Cents.	
1	American Dredging Co., Philadelphia, Pa	18	$2,970.00
2	John L. Mills, Camden, N. J	17	2,805.00
3	River and Harbor Improvement Co., Camden, N. J	15	2,475.00
4	Philadelphia Construction Co., Philadelphia, Pa	36	5,940.00
5	Delaware Construction Co., Wilmington, Del	40	6,600.00

Contract (dated June 22, 1899) entered into with River and Harbor Improvement Company. In progress.

CONTRACT IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With the River and Harbor Improvement Company, of Camden, N. J., dated June 22, and approved July 13, 1899, for dredging in the creek. Work to be commenced on or before July 10, 1899, and completed on or before December 10, 1899.

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1897 and 1898.

Kind of vessel.	Arrivals.				Departures.			
	1897.		1898.		1897.		1898.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	62	6,500	65	7,000	62	6,500	65	7,000
Sailing vessels	30	3,000	20	2,000	30	3,000	20	2,000
Barges and canal boats	57	8,700	60	9,000	57	9,300	60	9,000
Total	149	18,200	145	18,000	149	18,800	145	18,000

Freight statement.

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Coal	9,000	$20,000	9,000	$20,000
Glass sand	1,700	1,800	16,000	18,000
Lumber	3,000	30,000	2,500	30,000
Oyster shells	2,500	5,000	2,500	5,000
Soda ash	450	8,000	450	7,000
Tin plate	1,300	100,000	1,500	100,000
Miscellaneous	9,000	192,000	2,000	31,000
Total	26,950	356,800	33,950	211,000
DEPARTING.				
Canned goods	8,000	380,000	8,000	375,000
Glass	2,000	100,000	2,000	125,000
Grain	3,500	50,000	2,400	40,000
Produce			1,100	10,000
Ship timber	125	3,000	125	2,500
Miscellaneous	1,000	3,000	1,500	3,000
Total	14,625	536,000	15,125	555,500

H 10.

IMPROVEMENT OF COOPER CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 931; 1897, page 1223, and 1898, page 1100.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which amount $2,500, or so much thereof as might be necessary, was to be expended in rebuilding the dike on Government reservation in the Delaware River at Woodbury Creek.

Under date of October 7, 1896, contract was entered into with Frank O. Somers, of Camden, N. J., for rebuilding the dike on the Government reservation at Woodbury Creek. Work under this contract was completed on November 13, 1896, the total amount expended being $2,500.

Under date of October 19, 1896, contract was entered into with A. M. Clegg, of Washington, D. C., for dredging about 162,000 cubic yards of material from the channel of the creek. Work under this contract was commenced on April 12, 1897.

During the past fiscal year dredging was in progress under the above contract and subsequent agreements authorized by the War Department, 114,377 cubic yards, scow measurement, having been dredged from the channel, making a total to date of 162,167 cubic yards. The rk was completed on December 27, 1898, the total cost, including inspection and superintendence, being $24,979.80. The following results were obtained:

The channel had a depth of 18 feet at mean high water from the 12-foot low-water contour in the Delaware River over a width of 70 feet and length of 4,800 feet to just above the Moro Phillips Chemical Works, except at State Street Bridge, where the width was 30 feet and least high water depth 14 to 15 feet on a water pipe belonging to the city of Camden, which crosses the creek at that locality; thence a width of 50 feet, excepting at the Pennsylvania Railroad and Federal Street bridges, where the widths were 30 feet, over a further length of 2,700 feet to a point opposite the hay wharf of the Camden Iron Works, which is about 1,500 feet below the upper limit of the proposed improvement.

In May, 1899, by the hire of a dredge, the channel at State Street Bridge was further improved by dredging and the removal of 21 old piles belonging to former bridges on the same site, at a cost of $497.50. The work could not be fully completed on account of the water pipe belonging to the city of Camden at that locality. The amount of material removed was 1,263 cubic yards, scow measurement.

There is an available balance of $8,825.07 remaining from the appropriation of June 3, 1896, which it is proposed to use under another contract in completing the improvement according to project as soon as the city of Camden removes or lowers the water pipe at State Street Bridge below the plane of proposed dredging. The pipe at its present height limits the draft of vessels and destroys the value of the improvement. The project can be completed with the funds now available.

This work is located in the collection district of Philadelphia. This is the nearest port of entry. The collections during the year ending December 31, 1898, amounted to $19,791,682.75. The nearest fort and light-house are, respectively, Fort Mifflin and Upper Horseshoe range lights.

Money statement.

July 1, 1898, balance unexpended	$31,118.48
June 30, 1899, amount expended during fiscal year	22,293.41
July 1, 1899, balance unexpended	8,825.07

Appropriations.

Act of June, 3, 1896	$37,000.00

Expenditures.

Rebuilding dike on Government reservation in Delaware River at Woodbury Creek	$2,500.00
Improvement of Cooper Creek, New Jersey	25,674.93
Total to June 30, 1899	28,174.93

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1897 and 1898.

Kind of vessel.	Arriving.				Departing.			
	1897.		1898.		1897.		1898.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	16	4,800	653	26,120	16	4,800	653	26,120
Sailing vessels	99	79,200	47	4,700	99	79,200	47	4,700
Barges and canal boats	670	140,000	833	166,600	670	140,000	833	166,600
Total	785	224,000	1,533	197,420	785	224,000	1,533	197,420

Freight statement.

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Bricks	600	$2,800	....	....
Chemicals	11,239	163,151	13,177	$193,100
Coal	41.553	102,704	55,865	158,420
Fertilizers	5,614	73,000	6,174	80,300
Grain	....	....	562	7,600
Hay	240	1,950	1,215	9,423
Iron, pig	40,840	428,820	44,428	533,136
Iron, scrap	....	....	838	6,704
Lumber	1,000	11,000	600	7,500
Manure	20,000	35,000	23,500	36,500
Oil	7,188	96,071	9,200	126,000
Sand	10,000	11,500	5,000	7,000
Miscellaneous	10,507	254,425	5,144	237,044
Total	148,781	1,180,421	165,703	1,402,727
DEPARTING.				
Chemicals	70	1,400	77	1,540
Fertilizers	8,000	160,000	8,800	176,000
Iron, manufactured	24,370	422,820	19,535	390,700
Produce	30,000	600,000	35,000	650,000
Miscellaneous	1,216	103,504	1,500	123,750
Total	63,656	1,287,724	64,912	1,341,990

H II.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 933; 1897, page 1225, and 1898, page 1102.

During 1893, 15,770 cubic yards of material, scow measurement, were dredged from the channel below Goshen Landing, thus practically completing the improvement to the mouth of the creek. Work was then discontinued until 1897, for want of sufficient funds.

Under date of March 15, 1897, contract was entered into with Mr. Frank C. Somers, of Camden, N. J., for constructing about 600 feet of pile dike at the entrance of the creek and dredging about 8,000 cubic yards, scow measurement, from the channel. Work under this contract was commenced on May 18, 1897.

During the fiscal year ending June 30, 1897, the pile dike was constructed to its projected length of 600 feet, and 8,002 cubic yards of material, dipper measurement, were removed from the channel in the vicinity of the dike, completing the work under this contract on June 30, 1897.

The original cost of the project made in 1891, was estimated at $12,000, this estimate being based on a single appropriation of $12,000, by which the improvement could be made in a single season. On account of the small appropriations the work has been carried through an interval of several years, and it has not been executed with sufficient rapidity to prevent injurious changes which will considerably increase the cost of the improvement.

During the fiscal year ending June 30, 1898, an examination of the dike and dredged channel was made, and a new estimate, based on a careful survey of the existing conditions, was made of the cost of completing the work in accordance with the project. In order to maintain the dredged channel it is necessary to extend the dike somewhat farther toward the shore and to dredge through the bar at the mouth of the creek.

The cost of this work, in addition to funds then available, was estimated at $8,000, which will increase the cost of the project from $12,000, as originally estimated, to $17,000. Authority to make this increase was granted July 15, 1898.

The river and harbor act of March 3, 1899, appropriated $8,000 for the completion of this improvement. During the past fiscal year a project for the expenditure of this sum and the unexpended balance of the previous appropriation was submitted and approved April 21, 1898.

The project provides for the strengthening of the existing dike by the use of either sheet piling or brush wattling, riprapping its lower side with stone, and afterwards filling it with dredged material; for the construction of about 400 feet of brush and stone dike to connect the present dike with the shore at high-water mark; for the building of a similar dike of brush and stone 180 feet in length, or longer if funds will permit, on the north side of the entrance to the creek; for the redredging of the channel through the bar to a depth of 3 feet at mean low water over a width of 50 feet; to extend this channel by dredging about 700 feet to deep water inside the mouth of the creek, and thence to dredge a channel of the same depth over a width of 30 feet, to the lower end of the existing dredged channel in the creek, the dredged material to be deposited as a filling for the existing dike and as a backing for those proposed.

Under date of May 19, 1899, an informal agreement was entered into with E. P. Hand and Charles R. Mixner, of Cape May Court House, N. J., for furnishing and delivering brush and poles for the proposed brush and stone dikes to be constructed under the above project.

Under this agreement work commenced June 1, 1899, and is still in progress. Up to June 30, 1899, 310 cords of brush and 150 poles had been delivered under this agreement.

Under date of June 2, 1899, an informal agreement was entered into with the Delaware Construction Company, of Wilmington, Del., for furnishing and delivering the stone required for the work under the project.

Under this agreement work commenced June 14, 1899, and is still in progress.

Up to June 30, 1899, 371 tons of stone had been delivered under this agreement.

The dredging required by the project will be completed during the present season.

The funds on hand are sufficient to complete the projected improvement, and no further appropriation is required.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1898. The nearest fort is Fort Delaware, and the Maurice River light is the nearest light-house.

Money statement.

July 1, 1898, balance unexpended		$1,554.64
Amount appropriated by river and harbor act approved March 3, 1899		8,000.00
		9,554.64
June 30, 1899, amount expended during fiscal year		14.55
July 1, 1899, balance unexpended		9,540.09
July 1, 1899, outstanding liabilites	$568.11	
July 1, 1899, amount covered by uncompleted contracts	5,347.50	
		5,915.61
July 1, 1899, balance available		3,624.48

Appropriations.

Act of—	
July 13, 1892	$3,000
August 18, 1894	3,000
June 3, 1896	3,000
March 3, 1899	8,000
Total	17,000

Expenditures.

Total to June 30, 1899	$7,459.91

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1897 and 1898.

Kind of vessels.	Arrivals.				Departures.			
	1897.		1898.		1897.		1898.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Sailing vessels	100	2,000	120	3,000	100	2,000	120	3,000

Freight statement.

Articles.	1897.		1898.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Brick	2,500	$10,000	2,600	$17,800
Coal	1,500	7,500	1,800	5,400
Fertilizers	1,500	48,000	1,600	42,000
Grain	5,000	90,000	5,400	75,600
Lumber	3,000	30,000	3,200	35,000
General merchandise	2,000	100,000	2,000	200,000
Total	15,500	285,500	16,600	375,800
DEPARTING.				
Fertilizers	1,000	4,000	900	4,500
Hay	3,000	16,000	3,500	21,000
Oysters and clams	2,000	37,000	2,500	98,000
Potatoes	400	1,600	600	7,800
Sand	4,000	4,000	4,500	2,200
Wood	1,700	10,000	1,500	4,500
General merchandise	2,000	40,000	2,500	50,000
Total	14,100	112,600	16,100	188,000

H 12.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

This stream rises in Gloucester County, pursues a northwesterly course, and enters the Delaware River at a point 3 miles below League Island and opposite Mifflin Bar.

It is navigable at high water for a distance of one-half mile above its mouth to the Phosphate Works of the I. P. Thomas & Sons Co. for vessels of 13 feet draft; thence 3¼ miles farther to Paulsboro for vessels drawing 9 feet; thence 3.4 miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua (11¼ miles above the mouth) small boats and barges of 3 to 4 feet draft pass up on the tide. The navigable portion is generally bordered by low ground protected from overflow by earthen banks. The general course of the stream is tortuous and its navigation is much obstructed by bars, sharp bends, and in the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkeley Bridge, and 2 feet at Mantua.

The low-water width near the mouth averages 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreases to 88 feet at Parkers Landing, and near Mantua to 50 feet.

The stream is crossed by 4 bridges—a county-road bridge at Paulsboro, with a drawspan of 40 feet; the Delaware River Railroad bridge at the same place, with a drawspan of 32.9 feet; and at Berkeley, by the Swedesboro Turnpike bridge, without a draw (channel opening 27 feet), and just above the latter structure, by the bridge of the West Jersey and Seashore Railroad, also without a draw, the channel span being 27 feet and its height above mean low water about 14.5 feet.

The project for this improvement is contained in a report dated October 22, 1897, which is printed in the Annual Report of the Chief of Engineers for 1898, page 1122.

The improvement proposed is the formation, by dredging, of a channel 100 feet wide at bottom and 12 feet deep from the 12-foot contour in Delaware River to the Phosphate Works, thence 80 feet wide at bottom and 8 feet deep to Paulsboro, and thence 60 feet wide at bottom and 7 feet deep to Parkers Landing; 9,000 feet above Berkeley, the construction of a cut-off 350 feet long, 50 feet wide, and 3 feet deep; the removal of overhanging trees above Parkers Landing and the supplementing of the channel across the bar at the mouth by jetties on both sides aggregating 1,350 feet in length, if found necessary for its maintenance.

Two plans for securing the channel are proposed.

The first contemplates the formation of a dredged channel by making cut-offs, six in number, through the lowlands wherever practicable, avoiding shoals and sharp bends, subject to the condition that all rights of way privileges can be secured and riparian rights quieted for a sum not exceeding $11,000.

The second provides that in case the rights of way can not be secured and riparian rights quieted for the sum of $11,000, the route of the channel between the Phosphate Works and Parkers Landing is to follow the present course of the stream, widening at the bends.

The improvement by the first plan involves the removal of 411,500 cubic yards of material, place measurement, and its cost is estimated at $145,030; the second plan involves the removal of 405,500 cubic yards of material, and its cost is estimated at $141,400.

It is proposed to cast the dredged material on the banks and behind the dikes, or otherwise dispose of it so that it shall not impair navigation.

This project was adopted by Congress in the river and harbor act of March 3, 1899, which appropriated $25,000 for the improvement, subject to the following provision:

> *Provided*, That no part of any money appropriated for this project in excess of eight thousand dollars shall be expended for right of way privileges, easements, or other rights above the Phosphate Works and below Paulsboro, and no part thereof shall be expended for any such purpose unless all rights are secured for an amount not in excess of said sum of eight thousand dollars.

By authority of the Department the submission of a project for the expenditure of available funds will be deferred until it is ascertained whether all the rights of way privileges, easements, and other rights between the Phosphate Works and Paulsboro can be acquired for the sum of $8,000, as provided in the act of March 3, 1899.

The commercial statistics for this work are for the year 1898, the latest that could be obtained.

This work is located in the collection district of Philadelphia. This is the nearest port of entry, the collections during the year ending December 31, 1898, amounting to $19,791,682.75. The nearest fort and light-house are, respectively, Fort Mifflin and Tinicum Island range lights.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$25,000.00
July 1, 1899, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	120,030.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

Act of August 2, 1882	$3,000
Act of March 3, 1899	25,000
Total	28,000

Expenditures.

Total to June 30, 1899	$3,000

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the year ending December 31, 1898.

Kind of vessels.	Arriving.		Departing.	
	No.	Tons.	No.	Tons.
Steamers	1,113	55,975	1,113	55,975
Sailing vessels	785	66,400	785	66,400
Barges and canal boats	825	92,040	825	92,040
Car floats	105	15,750	105	15,750
Total	2,828	230,165	2,828	230,165

Freight statement.

Articles.	Tons.	Value.
ARRIVING.		
Brick	575	$34,500
Chemicals	8,845	142,880
Coal	6,000	24,000
Fertilizer material	13,964	350,000
Hay	3,000	12,000
Lumber	6,050	89,500
Machinery	300	30,000
Manure	33,000	66,000
Salt	350	5,250
Sand	1,000	1,000
Stone	2,200	8,500
Miscellaneous	6,250	463,500
Total	81,534	1,227,130
DEPARTING.		
Chemicals	1,500	15,000
Fertilizers manufactured	16,300	326,000
Manufactured goods	3,500	140,000
Sand and gravel	12,000	12,000
Truck, produce, and grain	30,400	729,600
Wood, cord	350	1,050
Miscellaneous	2,000	40,000
Total	66,050	1,263,650

H 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During the past fiscal year three wrecks have been removed, two under the authority of the act of Congress approved June 14, 1880, and one under the authority of the act of Congress approved March 3, 1899.

In September, 1895, the three-masted schooner *Lottie K. Friend*, with a cargo of coal, was sunk in Delaware Bay in collision with another vessel, about 1¼ miles west from Ship John Light. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of February 18, 1897, a contract was entered into with Thomas Poynter and Elijah D. Register, of Lewes, Del., for the removal of the wreck for the sum of $1,100, the work to be completed on or before April 25, 1897. At the close of the fiscal year ending June 30, 1897, the removal of the wreck had not been completed. During the fiscal year ending June 30, 1898, no work had been done toward the removal of the wreck under the above contract, and on June 16, 1898, it was recommended that the contract be annulled and the remaining wreckage be removed by dredging at some time when dredging operations were in progress in the neighborhood. This recommendation was approved on June 18, 1898. During the past fiscal year nothing has been done towards the removal of the wreck.

In June, 1895, the schooner *Anna Maria*, engaged in the oyster trade of Maurice River, New Jersey, sunk without cargo in that river, about 1 mile above the mouth. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of July 26, 1898, a contract was entered into with Enoch Townsend and G. M. Van Sant for the removal of the wreck for the sum of $196. The removal of the wreck was completed in August, 1898.

In September, 1898, the schooner *Joseph R. Ellis*, with a cargo of about 100 tons of oyster shells, sunk on the western side of the ship channel of the Delaware River, above the head of Tinicum Island. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of December 10, 1898, a contract was entered into with William H. Keates for the removal of the wreck for the sum of $395. The work of removal was completed in January, 1899.

In October, 1898, the sloop *John W. Elliott* was sunk without cargo on the western edge of the eastern channel of the Delaware River at a point opposite the mouth of Alloway Creek, New Jersey. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of June 17, 1899, a contract was entered into with Virden & Ross for the removal of the wreck for the sum of $220. The work of removal is still in progress.

The amount expended during the past fiscal year upon removal of wrecks is $1,008.39.

Abstract of proposals for removal of wreck of schooner "Anna Maria" lying in Maurice River, about one mile above its mouth, opened July 18, 1898, by Lieut. Col. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Charles W. Johnston, Lewes, Del	$290
2	Richard Parrott, Newburg, N. Y	800
3	Enoch Townsend, Linwood, N. J., and G. M. Van Sant, Atlantic City, N. J	196
4	Frederick Craemer, Philadelphia, Pa	350
5	Robert L. Lake and Wm. T. Collins, Port Norris, N. J	895
6	Frank C. Arthur, Philadelphia, Pa	440
7	R. P. Fitch, New York, N. Y	284

Contract (dated July 26, 1898) entered into with Enoch Townsend and G. M. Van Sant.

Abstract of proposals for removal of wreck of schooner "Joseph R. Ellis," lying in Delaware River above the head of Tinicum Island, opened December 5, 1898, by Lieut. Col. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Wm. H. Keates, Atlantic City, N. J	$395
2	River and Harbor Improvement Co., Camden, N. J	600
3	Charles W. Johnston, Lewes, Del	845
4	James J. Cowgill, Paulsboro, N. J	844

Contract (dated December 10, 1898) entered into with Wm. H. Keates.

Abstract of proposals for removal of wreck of sloop "John W. Elliott," lying in Delaware River opposite the mouth of Alloway Creek, New Jersey, opened June 8, 1899, by Lieut. Col. C. W. Raymond, Corps of Engineers.

No.	Name and address of bidder.	Price.
1	Enoch Townsend, Linwood, N. J	$245
2	Virden & Ross, Lewes, Del	220
3	Frederick Craemer, Philadelphia, Pa	800
4	River and Harbor Improvement Co., Camden, N. J	250
5	Charles W. Johnston, Lewes, Del	224
6	Philadelphia Construction Co., Philadelphia, Pa	238
7	John L. Mills, Camden, N. J	247

Contract (dated June 17, 1899) entered into with Virden & Ross. In progress.

CONTRACT IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With Virden & Ross, of Lewes, Del., for removal of the wreck of the schooner *John W. Elliott,* dated June 17, and approved June 28, 1899. Work to be commenced June 25, 1899, and completed on or before July 25, 1899.

APPENDIX I.

IMPROVEMENT OF RIVERS AND HARBORS IN DELAWARE, IN MARYLAND EAST OF CHESAPEAKE BAY, AND OF INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

REPORT OF WM. F. SMITH, UNITED STATES AGENT, MAJOR OF ENGINEERS, UNITED STATES ARMY, RETIRED, IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Wilmington Harbor, Delaware.
2. Appoquinimink River, Delaware.
3. Smyrna River, Delaware.
4. Murderkill River, Delaware,
5. Mispillion River, Delaware.
6. Broadkiln River, Delaware.
7. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.
8. Susquehanna River above and below Havre de Grace, Md.
9. Chester River, Maryland, from Crumpton to Jones Landing.
10. Choptank River, Maryland.
11. La Trappe River, Maryland.
12. Warwick River, Maryland.
13. Broad Creek River, Delaware.
14. Nanticoke River, Delaware and Maryland.
15. Wicomico River, Maryland.
16. Manokin River, Maryland.
17. Pocomoke River, Maryland.
18. Queenstown Harbor, Maryland.
19. Rockhall Harbor, Maryland.
20. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

21. Crisfield Harbor, Maryland. (Annamessex River.)

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., July 15, 1899.

GENERAL: I have the honor to transmit herewith the annual report for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 182.

The amount expended for the improvement of the Christiana River and Wilmington Harbor to June 30, 1898, is $402,194.04, of which $262,345.84 was expended on the project of 1881 and its modifications.

The sundry civil act approved July 1, 1898, appropriated $205,846 for continuing the improvement, and for the expenditure of this amount a project was submitted on July 7, 1898; but owing to an opinion of the Acting Comptroller of the Treasury that as the appropriation was conceded to be insufficient for the completion of the entire project it could not be used, which opinion was subsequently reversed, there was some delay in making contracts for the work. The legal objection to the use of the appropriation having been removed, proposals for dredging and for rock removal for a channel depth of 18 feet at mean low water and a width of 150 feet to the pulp works, and the dredging required above those works by the project were advertised for and opened on October 10, 1898. Contracts, dated October 20, 1898, were made with the lowest bidders, the New York Dredging Company, of New York, for the dredging at 12.6 cents per cubic yard, place measurement, 3,500 yards to be removed daily, and John J. Fitzpatrick, of Plattsburg, N. Y., for the rock removal, at $7.13 per cubic yard, in place, the work to be completed by July 1, 1899. As these prices were lower than had been estimated, and as the available funds were sufficient for the purpose, supplemental contracts were made later under authority of the Secretary of War, at the same prices for dredging and rock removal, for an additional width of 50 feet, making the width 200 feet, which is within the limit fixed by the approved project for the improvement. Under the supplemental contract for rock removal the work is to be completed by October 1, 1899. The 18-foot depth of channel authorized was the extent to which the appropriation will go in the direction of an ultimate 21-foot depth.

Dredging was begun on December 19, 1898, at a point about 375 feet above Lobdell's Canal, with the hydraulic dredge *Boston*, and has continued, with some interruptions during the severe winter weather, to the present time. The channel was dredged upstream toward the Philadelphia, Wilmington and Baltimore Railroad cut-off bridge No. 3 until March 10, 1899, when the dredge was hauled back to the place of beginning to work downstream to the Delaware River, which during the winter it had been unable to do. This portion of the dredging was completed on May 19, and operations were then begun between the cut-off bridge and the Third Street Bridge, where dredging has been carried on to date. The operations to the close of the fiscal year consist of the dredging of a channel 200 feet wide and 18 feet deep at mean low water from just below the cut-off bridge to the 18-foot contour in the Delaware River, a distance of 7,299 feet; the dredging of a channel length of 2,213 feet between the cut-off bridge and the Third Street Bridge to the full dimensions, and 403 feet to but 100 feet wide, and a channel into the south draw of the cut-off bridge 100 feet long, of which 50 feet is 100 feet wide and 50 feet an average of 85 feet wide. The depth was made 18 feet at mean low water. Upon the completion of dredging in the section of the river, about 1,300 feet in length, below the mouth of the Brandywine, now in progress, and which will probably be in July a continuous channel 200 feet wide and 18 feet deep at mean low water will have been dredged from the 18-foot contour in the Delaware River to above the mouth of the Brandywine.

Under the contracts for rock removal the entire area of the upper ledge has been drilled and blasted and most of the broken rock removed to the required depth, and on the lower ledge an area of 3,724 square feet has been drilled and blasted, or about one-third of the entire area.

At the close of the fiscal year the maximum draft that can be carried over the shoalest part of the section of river which has just been dredged is 18 feet, and for the remainder of the river up to the pulp works it is 10 feet.

The river and harbor act of March 3, 1899, made provision for the completion of the project as follows:

> Improving harbor at Wilmington and Christiana River, Delaware: Continuing improvement, forty-five thousand dollars, of which amount twenty thousand dollars, or so much thereof as may be necessary, shall be used for maintenance, and the Secretary of War may enter into a contract or contracts for such materials and work as may be necessary to complete the project of improvement, in accordance with the project submitted by the Board of Engineers, in its report of October third, eighteen hundred and ninety-six, and including the removal of rock from the channel as recommended in the Annual Report of the Chief of Engineers for eighteen hundred and ninety-seven, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and five thousand seven hundred and eighty dollars, exclusive of the amount herein and heretofore appropriated, that being the amount reported by the Chief of Engineers as necessary to complete said project.

Measures are now in progress looking to the completion of the project.

The important commercial and shipbuilding interests of this city warrant liberal expenditures in making and maintaining a proper channel.

It is proposed to expend the amount asked for, if appropriated, in continuing work as approved.

Wilmington is a port of entry and in the collection district of Delaware. The amount of revenue collected there during the fiscal year ending June 30, 1899, was $29,000.

Money statement.

July 1, 1898, balance unexpended		$0.74
Amount appropriated by sundry civil act approved July 1, 1898		205,846.00
Amount appropriated by river and harbor act approved March 3, 1899		45,000.00
		250,846.74
June 30, 1899, amount expended during fiscal year		51,358.58
July 1, 1899, balance unexpended		199,488.16
July 1, 1899, outstanding liabilities	$8,250.00	
July 1, 1899, amount covered by uncompleted contracts	190,000.00	
		198,250.00
July 1, 1899, balance available		1,238.16
Amount (estimated) required for completion of existing project		205,780.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$205,780.00	
For maintenance of improvement	20,000.00	
		225,780.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved—	
July 14, 1836	$15,000
March 3, 1837	8,000
July 7, 1838	9,356
July 11, 1870	15,000
June 10, 1872	10,000
March 3, 1873	6,000
June 23, 1874	6,000
March 3, 1875	10,000
August 14, 1876	16,000
June 18, 1878	7,000

By act approved—		
March 3, 1879		$3,500
June 14, 1880		10,000
March 3, 1881		50,000
By act passed August 2, 1882		50,000
By act approved—		
July 5, 1884		25,000
August 5, 1886		18,750
By act of August 11, 1888		30,000
By act approved—		
September 19, 1890		30,000
July 13, 1892		40,000
By act of August 18, 1894		25,000
By act of June 3, 1896		20,000
		404,606
By act approved—		
July 1, 1898	$205,846	
March 3, 1899	45,000	
		250,846
Aggregate		655,452

Of the above the sum of $2,411.22 has been carried to the surplus fund of the Treasury.

Abstract of proposals for dredging and rock removal in Wilmington Harbor and Christiana River, Delaware, received by Gen. William F. Smith, United States agent, and opened October 10, 1898.

No.	Name and address of bidder.	Dredging.			Rock removal.		
		Time to—		Price per cubic yard, place measurement.	Time to—		Price per cubic yard.
		Commence.	Complete.		Commence.	Complete.	
			1899.	*Cents.*		1899.	
1	American Dredging Co., Philadelphia, Pa.	20 days	Aug. 31	17.1			
2	Rittenhouse Moore Dredging Co., Mobile, Ala.	60 days	June 30	18.0			
3	John J. Fitzpatrick, Plattsburg, N. Y.				30 days	July 1	$7.12
4	Atlas Dredging Co., Wilmington, Del.	30 days	Oct. 1	17.8			
5	The International Contracting Co., Syracuse, N. Y.	15 days	Oct. 1	14.90			
6	Isaac T. Brown, New York				30 days	Nov. 1, 98 (sic)	12.45
7	The International Contracting Co., Syracuse, N. Y.				30 days	July 1	19.00
8	P. Sanford Ross, Incorporated, Jersey City, N. J.				30 days	Sept. 15	14.70
9	H. T. Dunbar & Co., Philadelphia, Pa.				30 days	July 1	11.83
10	The New York Dredging Co., New York.	60 days	3,500 yds. daily.	12.6			
11	Sanford & Brooks Co., Baltimore, Md.	60 days	June 30	19.5			
12	Charles W. Johnston, Lewes, Del.				30 days	Sept. 30	13.45
13	Simon Hess, New York [a]	30 days	Nov. 1	14.28			
14	....do				60 days	July 1	20.00
15	Baltimore Dredging Co., Baltimore, Md.	30 days	Oct. 1	18.0			

[a] In conjunction with bid for rock removal.

Bid of New York Dredging Company for dredging and that of John J. Fitzpatrick for rock removal accepted.

Abstract of contracts in force.

Name of contractor.	Date of approval.	Date of beginning.	Date of expiration.
New York Dredging Co., for dredging.	Nov. 10, 1898	Dec. 19, 1898	3,500 cubic yards to be dredged daily until exhaustion of available funds.
New York Dredging Co. (Supplemental contract.)	Jan. 11, 1899	Dec. 21, 1899	Do.
John J. Fitzpatrick, for rock removal.	Nov. 1, 1898	May 20, 1898	July 1, 1899.
John J. Fitzpatrick. (Supplemental contract.)	May 9, 1899	May 20, 1899	October 1, 1899.

COMMERCIAL STATISTICS OF THE CITY OF WILMINGTON FOR THE CALENDAR YEAR 1898.

[Furnished by the Wilmington Board of Trade.]

The tonnage and value of leading articles shipped to and from the port of Wilmington by water during the year 1898 are as follows:

DOMESTIC COMMERCE.

Articles.		Quantity.	Value.
Coal	tons	41,500	$103,475
Cordwood	do	4,500	17,885
Iron supplies and steel	do	52,990	1,031,990
Quarry stone	do	81,275	194,225
Sand, building and molding	do	49,180	25,920
Ice	do	3,015	5,125
Cement	do	5,325	47,235
Machinery	do	20,115	185,925
Fertilizers	do	19,975	125,240
Powder	do	2,995	206,725
General merchandise	do	132,570	17,181,580
Miscellaneous and unclassified	do	200,875	7,745,350
Total	do	614,315	26,870,675

FOREIGN COMMERCE.

Imports:			
Cornwall stone	tons	1,900	10,000
China clay	do	650	4,000
Nitrate of soda	do	7,180	69,000
Rock plaster	do	1,400	3,500
Total	do	11,130	86,500
Exports:			
Barrel staves and headings			11,000
Railroad-car materials			88,000
Corn	bushels	226,000	84,000
Crude petroleum	gallons	72,000,000	2,900,000
Refined petroleum	do	22,000,000	1,800,000
Total			4,883,000
Total foreign imports and exports			4,969,500

There were engaged in foreign trade to and from this port (Marcus Hook) vessels of a total registered tonnage of 144,165 tons in the petroleum trade. These statistics relating to foreign trade were furnished by the collector of the port of Wilmington, Del.

Vessels trading in Wilmington Harbor not included above.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Steamers	5	1,670	6 to 10
Tugs	9	485	4 to 8
Schooners	9	610	
Barges	17	7,825	
Total	40	10,590	

The above vessels are engaged in daily river and harbor work. In addition, there are numerous vessels of all classes engaged in general coastwise trade of which no distinct record is kept. There passed in and out of our port during 1898 976 steamers, barges, tugs, schooners, vessels, floats, laden with merchandise or for repairs, not including our regular lines of daily connections.

There is invested in freight and passenger lines between Wilmington, Del., and Philadelphia, Pa., and Pennsgrove, N. J., over $1,000,000. These vessels carry annually 530,000 passengers, and freight valued at $16,500,000.

There is invested in manufacturing and mercantile interests on the Christiana River, all dependent upon the facilities of this river navigation, between $13,000,000 and $15,000,000.

The following statistics of vessels built and repaired at Wilmington, Del., were furnished by the Harlan & Hollingsworth Company, Jackson & Sharp Company, Pusey & Jones Company, and Enoch Moore & Sons Company.

Vessels built.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Steamers:			
Steel	6	4,907	8
Wood	1	200	
Do	1	822	
Tank and deck barge, wood	1	600	
Deck lighters, wood	4	1,450	
Dredging scows, wood	5	5,100	
Tugs, steel	2	737	
Barge, steel	1	30	
Total	21	13,846	

Vessels repaired.

	Aggregate tonnage.
Steamers	53,516
Ferryboats, steam yachts, tugs, etc	3,853
Sailing vessels	22,029
Dredges, barges, scows, etc	22,890
Total	102,288

I 2.

IMPROVEMENT OF APPOQUINIMINK RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 185.

The total amount expended on this improvement to June 30, 1898, was $10,990.04.

Under the contract dated July 2, 1897, made with Egan & Bochman, work was begun on July 13, 1898. As conveyances of the land required for the projected cut-offs at and below Thomas's landing were secured early in the fiscal year, the dredging required thereon was included in the contract work. Operations under the contract continued to March 31, 1899, and during this period the channel was dredged and shoals removed to a width of 50 feet and a depth of 8 feet at mean low water, as follows: At the upper point of, and through Quarter Mile Reach; from just below Polk's wharf to above the lower corner of the steamboat wharf at Odessa; in Windmill Reach and Tom's Bay Reach; below Windmill Reach and in the reach just above the one leading to New Bridge; the cut-off at No-Man's Friend Reach was widened to from 60 to 70 feet through the straight portion of it and still more at the ends, which were made fan-shape; a cut-off 625 feet in length was made through the marsh at Thomas's landing, and another, 960 feet long, through the marsh just below. The aggregate length of dredging done in these operations was about 8,000 feet. At the mouth of the river a cut 30 feet wide, and 5 feet deep at mean low water, was made for a length of 1,100 feet through the marsh from the 5-foot depth inside the river to the 5-foot depth in the slough outside, through which deep water in the Delaware River is reached just below Blackbird Creek. The quantity of material removed was 60,091 cubic yards. These operations resulted in a channel 50 feet wide and 8 feet deep, at mean low water, from the upper end of Quarter Mile Reach to the mouth of the river, with some slight exceptions. At the reach at New Bridge, where it is proposed to make a cut-off as soon as the right of way for it can be obtained, and at a shoal just below, the channel is but 6½ feet deep, and there are slight shoals in Rock Reach and two between there and the mouth of the river.

The maximum draft that can be carried June 30, 1899, at mean low water over the shoalest part of the river is 6 feet.

The river and harbor act of March 3, 1899, appropriated $5,000 for continuing this improvement, and proposals for the dredging to be done therewith are advertised to be opened July 10, 1899.

It is proposed to expend the amount asked for, if appropriated, in continuing work under the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1899, is $29,000.

Money statement.

July 1, 1898, balance unexpended		$9,009.96
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		14,009.96
June 30, 1899, amount expended during fiscal year		8,986.64
July 1, 1899, balance unexpended		5,023.32
Amount (estimated) required for completion of existing project		14,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$7,000.00	
For maintenance of improvement	1,000.00	
		8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved September 19, 1890	$5,000
By act approved July 13, 1892	5,000
By act of August 18, 1894	5,000
By act of June 3, 1896	5,000
By act approved March 3, 1899	5,000
Total	25,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, fertilizers, flour, etc	3,365	$145,600
Horses, sheep, etc	450	45,000
General merchandise	3,850	577,500
Total	12,665	768,100
Shipments:		
Canned goods	1,050	74,000
Fruit, wheat, poultry, sheep, etc	9,250	472,000
General merchandise	200	25,000
Total	10,500	571,000
Total receipts and shipments	23,165	1,339,100

Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	1	136	6	Triweekly two months, then semiweekly. General merchandise.
Tugs	3			Transient.
Schooners	2	150		Transient. Grain, coal, etc.
Barges	3	750		

The above statistics were furnished by Mr. F. B. Watkins, Odessa, Del., accompanied by the following letter:

ODESSA, DEL., *April 10, 1899.*

DEAR SIR: Inclosed find statistics as requested. Last year we built an iron hull freight and passenger steamer of 136 tons net, of lighter draft and more speed than the old boat, and our passenger trade was almost double of 1897. The trade for the year was fair, although the wheat crop was about half 1897; but our canneries were both running, packing over a million cans of corn and tomatoes and making a large increase in our export of canned goods for the year. Our greatest trouble now is the bar at the mouth of river, sometimes having to wait until high tide to get over.

Yours truly,

F. B. WATKINS.

Gen. WM. F. SMITH,
United States Agent.

I 3.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

For previous history see Anual Report of the Chief of Engineers for 1899, Part I, page 187.

Total amount expended on this improvement to June 30, 1898, was $36,961.76, of which $26,961.76 is on the present project.

No work was done on the project during the past fiscal year. The expenditures were for payment of outstanding liabilities and amounts due on contract at the close of last fiscal year.

The river and harbor act of March 3, 1899, appropriated $5,000 for continuing the improvement, and proposals for the dredging to be done therewith are to be opened July 10, 1899.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1899, is $29,000.

Money statement.

July 1, 1898, balance unexpended		$1,038.24
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		6,038.24
June 30, 1899, amount expended during fiscal year		1,033.73
July 1, 1899, balance unexpended		5,004.51
Amount (estimated) required for completion of existing project		4,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$4,365.00	
For maintenance of improvement	1,000.00	
		5,365.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved—		
June 14, 1880		$5,000
March 3, 1881		3,000
By act passed August 2, 1882		2,000
		10,000
By act of August 11, 1888	$10,000	
By act approved—		
September 19, 1890	5,000	
July 13, 1892	3,000	
By act of August 18, 1894	5,000	
By act of June 3, 1896	5,000	
By act approved March 3, 1899	5,000	
		33,000
Aggregate		43,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, iron ore and steel, phosphate, etc	7,200	$81,000
Canned goods, flour, mill work, etc	10,528	222,800
Cattle, grain, horses, sheep, etc	63,342	434,075
General merchandise	10,000	400,000
Total	91,070	1,137,875
Shipments:		
Railroad ties, ship timber, wood, etc	84,200	212,000
Canned goods, crates, fertilizers, terra cotta, etc	132,015	828,500
Fruit, grain, cattle, poultry, etc	19,739	854,550
General merchandise	10,000	400,000
Total	245,954	2,295,050
Total receipts and shipments	337,024	3,432,925

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	3	310	6	Two and three trips weekly.
Steam barge	1	97	6	Charter.

Several tugs were employed in shipment of wood, ties, and lime, and ten or more schooners and sloops.

The above statistics were furnished by the Philadelphia and Smyrna Transportation Company, accompanied by the following letter:

SMYRNA, DEL., *May 15, 1899.*

DEAR SIR: Please find inclosed statistics for 1898. There are some changes showing increase due to cutting of rates in half during past year. Of course this volume can not be held as a permanent increase. I have to report the establishing of a pickle factory at Smyrna Landing and the prospect of another cannery at the same point and one also at Flemmings Landing for next year. These factories are coming here to secure low water rates.

Yours, truly,

A. E. JARDINE,
Secretary and Treasurer.

Gen. WM. F. SMITH,
United States Agent, Wilmington, Del.

I 4.

IMPROVEMENT OF MURDERKILL RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 188.

The amount expended to June 30, 1898, was $18,482.55. In addition to this, $1,500 was expended in removing a shoal at the mouth of the St. Jones River, in accordance with the requirements of the river and harbor act of August 18, 1894.

No work has been done on the improvement during the fiscal year. The expenditure reported was for an examination of the river.

The river and harbor act of March 3, 1899, appropriated $5,000 for continuing this improvement, and proposals for dredging to be done therewith are advertised to be opened July 10, 1899.

The amount asked for, if appropriated, will be expended in dredging at the bar and in the river, in continuation of the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1899, is $29,000.

Money statement.

July 1, 1898, balance unexpended		$17.45
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		5,017.45
June 30, 1899, amount expended during fiscal year		13.35
July 1, 1899, balance unexpended		5,001.10
Amount (estimated) required for completion of existing project		27,764.00
Amount that can profitably be expended in fiscal year ending June 30, 1901:		
For works of improvement	$7,000.00	
For maintenance of improvement	1,000.00	
		8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved July 13, 1892	$7,000
By act of August 18, 1894	[1]6,500
By act of June 3, 1896	6,500
By act approved March 3, 1899	5,000
Total	25,000

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[1] Of this amount $1,500 was expended in removing shoal at mouth of St. Jones River.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, rock phosphate, ship timber, etc	5,234	$67,665
Lime, fertilizers, dressed lumber, etc	6,310	126,850
Horses, hay, etc	1,212	33,600
General merchandise	2,500	300,000
Total	15,256	528,115
Shipments:		
Cord wood and piling	2,800	35,000
Canned goods, barrels, baskets, etc	12,840	669,950
Corn, wheat, fruit, cattle, etc	9,501	268,150
General merchandise	550	66,000
Total	25,691	1,039,100
Total receipts and shipments	40,947	1,567,215

Vessels trading in Murderkill River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	350	6½	Semiweekly; freight and passenger.
Schooners	7	295	4 to 6	Weekly; grain, lumber, etc.

One steamer and two sailing vessels, aggregating 510 tons, repaired during the year.

The above statistics were furnished by Mr. Caleb J. Smithers, Frederica, Del.

I 5.

IMPROVEMENT OF MISPILLION RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 189.

The amount expended on this improvement to June 30, 1898, was $38,887.42, of which $21,887.42 is on the present project.

No work has been done during the past fiscal year. The expenditure was for liabilities outstanding June 30, 1898.

The river and harbor act of March 3, 1899, appropriated $2,500 on this improvement, and proposals for work to be done therewith are advertised to be opened July 10, 1899.

It was impracticable to obtain detailed commercial statistics, but it is stated that the commerce was about the same last year as in the preceding year, when it was reported as 83,129 tons, and a valuation of $1,676,704.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1899, is $29,000.

Money statement.

July 1, 1898, balance unexpended	$112.58
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	2,612.58
June 30, 1899, amount expended during fiscal year	112.06
July 1, 1899, balance unexpended	2,500.52
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—		
March 3, 1879	$3,000	
June 14, 1880	4,000	
March 3, 1881	3,500	
By act passed August 2, 1882	3,000	
By act of August 11, 1888	3,500	
		$17,000
By act approved July 13, 1892	12,000	
By act of August 18, 1894	10,000	
By act approved March 3, 1899	2,500	
		24,500
Aggregate		41,500

I 6.

IMPROVEMENT OF BROADKILN RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 190.

The amount estimated for the completion of the existing project is for the improvement at the mouth of the river as designed in 1871 and modified in 1881. No work has been done on it since 1890, and no funds have been available for the purpose. I do not recommend any expenditure at present for an outlet for the Broadkiln into Delaware Bay, taking into consideration that success in making it will be most uncertain and the probability that the Broadkiln can be connected with the inland waterway from Chincoteague Bay to Delaware Bay at Lewes at much less cost and with greater advantage to both.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1899, is $29,000.

It was not practicable to obtain commercial statistics.

Money statement.

Amount (estimated) required for completion of existing project	$21,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

AMOUNTS APPROPRIATED.

By act approved—		By act passed August 2, 1882	$5,000
March 3, 1873	$10,000	By act of August 11, 1888	10,000
June 14, 1880	5,000		
March 3, 1881	5,000	Total	35,000

I 7.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE BAY, AT OR NEAR LEWES, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 190.

The amount expended on this improvement to June 30, 1898, was $167,249.36.

The river and harbor act of June 3, 1896, appropriated $25,000 for continuing this improvement, to be used from Delaware Bay to Indian River, and provided "that no part of this appropriation shall be expended until the right of way is secured without cost to the United States, but the right of way over any railroad or county bridge shall not be subject to this proviso and may be secured by condemnation proceedings."

Such proceedings for the acquisition of title to the crossing of the Delaware, Maryland and Virginia Railroad Company at Rehoboth, Del., were in progress at the time of my last report, and during the past fiscal year were brought to a conclusion. The commissioners of Rehoboth, as successors of the Rehoboth Beach Association, which owned the land at the time of its condemnation for the use of the Junction and Breakwater Railroad Company, of which the Delaware, Maryland and Virginia Railroad Company are the successors, made a voluntary deed, dated January 13, 1899, conveying to the United States whatever interest that corporation had in the land at the place named; and an award was made by certain commissioners appointed under and by virtue of an act of the general assembly of the State of Delaware, entitled "An act in relation to the proposed canal intended as a free inland waterway connecting Assawaman Bay with Delaware Bay," passed at Dover, April 4, 1884, and the supplements thereto. The commissioners made the award in terms as follows:

> After considering the premises and the advantages and disadvantages which will accrue to the said owner by reason of the taking and appropriation of its said land, and the construction of said canal; and the cost of the erection and maintenance of a proper bridge, with a suitable draw of the style and character shown on the plan hereto attached, and made part of the return, where said canal is to cross the right of way of the said railroad company, at the place aforesaid, (which said bridge is to be erected and maintained, and the said draw is to be operated by the said railroad company, its successors and assigns), the undersigned did assess and determine the amount of damages which the said owner will sustain by reason of the location and construction of the said canal, and the erection and maintenance of the said bridge and the operation of the said draw (the erection, maintenance and operation whereof are rendered necessary by, and directly result from the taking of said parcel of land for the location and construction of said canal) at the sum of thirty-seven thousand three hundred and forty-three 58/100 dollars ($37,343.58), and do hereby award the said The Delaware, Maryland and Virginia Railroad Company the sum of thirty-seven thousand three hundred and forty-three 58/100 dollars ($37,343.58).

The amount asked for, if appropriated, will be expended in continuing the improvements between Chincoteague Inlet and Delaware Bay. The most useful work to be done is between Ocean City, Md., and Indian River Bay.

Money statement.

July 1, 1898, balance unexpended	$26,500.64
June 30, 1899, amount expended during fiscal year	5.92
July 1, 1899, balance unexpended	26,494.72
Amount (estimated) required for completion of existing project	156,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act of August 5, 1886	$18,750
By act of August 11, 1888	50,000
By act approved September 19, 1890	50,000
By act approved July 13, 1892	25,000
By act of August 18, 1894	$25,000
By act of June 3, 1896	25,000
Total	193,750

I 8.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MD.

For full history see Annual Report of the Chief of Engineers for 1899, Part I, page 192.

Up to the close of the fiscal year 1898 $161,067.37 had been expended on this section of the river, including $49,729.15 for dredging the channel to the Fishing Battery Light-House, for breakwaters and piers, and for other work for the Fish Commission.

The funds on hand are of the appropriations of 1890, 1892, and 1894. As the amount is small and is limited to expenditure above the Philadelphia, Wilmington and Baltimore Railroad bridge, no work has been undertaken on the project during the past fiscal year, but some dredging at Watson Island will probably be necessary soon.

The expenditure during the past fiscal year was for the removal of rock obstructing the channel leading to the wharves at Port Deposit and distant about 150 feet therefrom.

Susquehanna River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

It was impracticable to obtain complete commercial statistics.

Money statement.

July 1, 1898, balance unexpended	$9,822.63
June 30, 1899, amount expended during fiscal year	88.58
July 1, 1899, balance unexpended	9,734.05
Amount (estimated) required for annual dredging	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

AMOUNTS APPROPRIATED.

By act approved—		
August 30, 1852	$10,000	
June 23, 1866	26,400	
July 25, 1868 (allotment)	5,000	
April 10, 1869 (allotment)	990	
July 11, 1870	12,000	
June 14, 1880	28,000	
March 3, 1881	15,000	
		$97,390
By act passed August 2, 1882	25,000	
By act approved—		
July 5, 1884	20,000	
August 5, 1886	6,000	
By act of August 11, 1888	10,000	
By act approved—		
September 19, 1890	4,000	
July 13, 1892	4,000	
1879, allotment from general appropriation for examinations and surveys	500	
By act of August 18, 1894	4,000	
		73,500
Aggregate		170,890

I 9.

IMPROVEMENT OF CHESTER RIVER, MARYLAND, FROM CRUMPTON TO JONES LANDING.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 193.

The amount expended on the improvement to June 30, 1898, was $9,480.90.

The contract made in December, 1896, with Chester T. Oaler, of Norfolk, Va., for dredging on this and other improvements along the Eastern Shore of Chesapeake Bay, required their completion by June 30, 1898; but this work not having been reached by the stipulated time, he was, by authority of the Chief of Engineers, granted an extension of six months. Operations under it were begun on this improvement on November 1, 1898, and completed on the 30th of the same month. Dredging was begun at a point 520 feet above Kirbys Landing. This was 300 feet below the point where dredging was suspended under the previous contract, and was necessary on account of shoaling which had taken place, and the channel thence up stream was made 60 feet wide and 6 feet deep at mean low water for a distance of 1,700 feet. This left a stretch of about 1 mile to be improved to complete the project. The quantity of material removed was 10,483 cubic yards, consisting of sand and mud, which was deposited upon the marsh and flats on either side of the channel.

The river and harbor act of March 3, 1899, appropriated $3,200 for the completion of the project, and it is expected that a contract for this and for other improvements along the Eastern Shore will be made soon.

This work is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended	$1,519.10
Amount appropriated by river and harbor act approved March 3, 1899	3,200.00
	4,719.10
June 30, 1899, amount expended during fiscal year	1,398.84
July 1, 1899, balance unexpended	3,320.26
July 1, 1899, outstanding liabilities	120.26
July 1, 1899, balance available	3,200.00

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	$5,000
July 13, 1892	3,000
By act of August 18, 1894	1,500
By act of June 3, 1896	1,500
By act of March 3, 1899	3,200
Total	14,200

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Fertilizers	1,732	$43,300
General merchandise	24,439	977,560
Total	26,171	1,020,860
Shipments:		
Oysters, tomatoes, fruits, etc	11,064	364,485
General merchandise	41,966	1,678,640
Total	53,030	2,043,125
Total receipts and shipments	79,201	3,063,985

Vessels trading in Chester River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	4	1,553	6 to 7½	Daily service, one of the steamers a day.

The above statistics were furnished by the Chester River Steamboat Company, and represent the business of that line only.

I 10.

IMPROVEMENT OF CHOPTANK RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 193.

The amount expended on this improvement to June 30, 1898, was $50,159.63.

On December 24, 1896, a contract was made for dredging on this and other improvements along the eastern shore of Chesapeake Bay, the entire work to be completed by June 30, 1898. The contractor not having reached this work by the stipulated time, he was, by authority of the Chief of Engineers, granted an extension of six months, and, later, a further extension of six months. Under this contract dredging was begun on December 12, 1898, and completed January 28, 1899. During this period a cut 40 feet wide was dredged between the bridge at Greensboro and a point 1,130 feet below, at which point dredging in an upriver direction had stopped in previous operations, and several shoals from 10 to 30 feet wide and aggregating 830 feet in length were dredged to the approved depth; and at Brick Mills the channel was dredged for a length of 1,000 feet to a width of 65 feet. The depth made in these operations was 8 feet at mean low water. The quantity of material removed was 15,988 cubic yards, consisting of sand and clay, with some gravel, and was deposited on the banks on the east and west sides of the river.

The river and harbor act of March 3, 1899, appropriated $8,000 for continuing this improvement, and it is expected that a contract embracing this and other works along the eastern shore of Chesapeake Bay will soon be made.

It is proposed to expend the amount asked for, if appropriated, in continuing dredging under the project.

Choptank River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended		$1,840.37
Amount appropriated by river and harbor act approved March 3, 1899		8,000.00
		9,840.37
June 30, 1899, amount expended during fiscal year		1,688.20
July 1, 1899, balance unexpended		8,152.17
July 1, 1899, outstanding liabilities		151.89
July 1, 1899, balance available		8,000.28
Amount (estimated) required for completion of existing project		8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$8,000.00	
For maintenance of improvement	1,000.00	
		9,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	5,000
By act passed August 2, 1882	5,000
By act approved—	
July 5, 1884	5,000
August 5, 1886	10,000
By act of August 11, 1888	7,500
By act approved—	
September 19, 1890	7,500
July 13, 1892	3,000
By act of August 18, 1894	2,000
By act of June 3, 1896	2,000
By act approved March 3, 1899	8,000
Total	60,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Ice, oysters, fish	121	$1,756
Canned goods, fertilizers, lumber, etc	3,490	103,646
Cattle, horses, sheep, etc	415	48,644
General merchandise	7,325	293,000
Total	11,351	447,046
Shipments:		
Canned goods, lumber, flour, etc	1,574	72,310
Fruit, grain, cattle, etc	4,087	116,516
General merchandise	2,000	80,000
Total	7,661	268,826
Total receipts and shipments	19,012	715,872

Vessels trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	1,208	5½	Daily service alternately.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company, and represent the business of that line only.

I 11.

IMPROVEMENT OF LA TRAPPE RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 194.

The amount expended to the close of the fiscal year 1898 was $7,213.87 and the channel within the river had been completed. The proposed channel at the mouth, about 1,600 feet long, had been dredged to the approved width of 150 feet for a distance of 400 feet and to a width of 100 feet only for the remaining 1,200 feet. No work has been done during the past fiscal year. The latter portion, therefore, remains to be widened 50 feet in order to conform to the approved project, and it is estimated that to complete it $2,500 will be required, in addition to the amount already expended and originally estimated as the cost of the whole improvement. This increase in the estimate is solely due to shoaling in the upper river since the survey was made and to the treacherous character of the material at the bar. The latter consists principally of live pure sand, and already, during the progress of the first contract, at that point it became necessary to remove and pay for a much larger quantity of material on that account than was estimated for and the depth of cutting had to be increased to maintain the dredged depth, the contract being for scow measurement. It is expected, however, that the additional amount asked for will complete the channel if no unforeseen shoaling has taken place since operations were suspended.

La Trappe River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended	$36.13
July 1, 1899, balance unexpended	36.13
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved July 13, 1892	$2,500
By act of August 18, 1894	4,750
Total	7,250

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, bricks, flour, etc	2,151	$18,630
Horses, potatoes, sheep, etc	113	4,150
General merchandise	2,500	100,000
Total	4,764	122,780
Shipments:		
Cord wood and canned goods	705	21,250
Fruit, grain, poultry, sheep, etc	1,942	52,400
Total	2,647	73,650
Total receipts and shipments	7,411	196,430

Vessels trading in La Trappe River, Maryland, engaged in general trade.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Steamers	3	1,075	9
Schooners	2	150	6½
Do	1	68	7½
Do	1	60	9
Do	2	76	5

The above statistics were furnished by Jas. T. Mullikin, Trappe, Md., accompanied by the following letter:

WHEELER TRANSPORTATION LINE,
Trappe, Md., March 20, 1899.

DEAR SIR:

* * * * * * *

Last year was a very dull year with us here in this neighborhood.

The drought cut our corn crop short—only got about two-thirds of a crop. Also in our wheat we only got about two-thirds of a crop, and that was nearly all screen wheat. We also had very little fruit; our largest fruit farm of 100 acres of 10,000 peach trees did not ship a single package. We had a very poor crop of corn, wheat, and fruit.

Right much of our lumber came from Pennsylvania by rail last year for the first time on account of the boats being busy running shells, etc., and could not get the size boats that was wanted on account of the depth of water at the mouth of the river. It is true that we have lost some freight and business on account of the boats not being able to get in when we have a heavy northwest wind. They have to ride 9 miles, to Oxford, to catch the boat.

Respectfully,

JAS. T. MULLIKIN.

General WM. F. SMITH,
United States Agent.

I 12.

IMPROVEMENT OF WARWICK RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 195.

The amount expended on this improvement to June 30, 1898, was $14,447.52, of which $8,447.52 is on the present project.

The operations which were in progress at the close of last fiscal year under the contract of Chester T. Caler, dated December 24, 1896, were continued to July 7, 1898. A cut 25 feet wide and 400 feet long was dredged across Spences Bar, just below the entrance to the turning basin, and the turning basin was dredged at several places where it had shoaled. This left about 2,050 feet of the channel to be dredged to the approved dimensions under the project.

The quantity of material removed under the contract was 15,012 cubic yards, consisting of mud with some sand, and this was scowed away and deposited in 40 feet of water in the Choptank River just above Jamaica Point.

The river and harbor act of March 3, 1899, appropriated $2,000 for continuing this improvement, and it is expected that a contract embracing this and other works along the Eastern Shore of Chesapeake Bay will be made soon.

It is proposed to expend the amount asked for, if appropriated, in continuing dredging under the project.

Warwick River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended		$1,552.48
Amount appropriated by river and harbor act approved March 3, 1899		2,000.00
		3,552.48
June 30, 1899, amount expended during fiscal year		1,406.25
July 1, 1899, balance unexpended		2,146.23
July 1, 1899, outstanding liabilities		142.61
July 1, 1899, balance available		2,003.62
Amount (estimated) required for completion of existing project		6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$3,600.00	
For maintenance of improvement	400.00	
		4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved June 14, 1880	$3,000
By act approved March 3, 1881	3,000
Total	6,000
By act approved July 13, 1892	6,000
By act of August 18, 1894	2,000
By act of June 3, 1896	2,000
By act of March 3, 1899	2,000
Total on present project	12,000
Aggregate	18,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Fish, canned goods, flour, etc	1,373	$30,682
Cattle, horses, etc	183	4,481
General merchandise	681	27,240
Total	2,237	62,403
Shipments:		
Canned goods, fertilizers, etc	383	22,790
Fruit, wheat, farm products, etc	934	26,821
General merchandise	660	26,400
Total	1,977	76,011
Total receipts and shipments	4,214	138,414

Vessels trading in Warwick River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	1,206	5½	Daily service alternately.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company and represent the business of that line only. About 102 sloops, bugeyes, and schooners also trade here.

I 13.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 196.

The amount expended to June 30, 1898, was $45,194.26, of which $35,000 was expended before the adoption of the present project and $5,000 for the removal of a bar which extended from the railroad bridge at Seaford, on the Nanticoke River, toward the mouth of that river. With the $5,000 appropriated by the river and harbor act of June 3, 1896, the channel was dredged between May 11 and June 30, 1899, to the approved dimensions from a point about 300 feet above Hitch's upper wharf, upstream, for a distance of 5,060 feet. The quantity of material removed was 39,981 cubic yards, and consisted of sand and gravel, which was deposited upon and back of the old dredged banks on both sides of the river. This leaves about 1,800 feet of the channel to Laurel to be dredged to the project dimensions.

The river and harbor act of March 3, 1899, appropriated $5,000 for completing this improvement, and it is expected that a contract for dredging, embracing this and other improvements along the eastern shore of Chesapeake Bay, will be made soon.

Broad Creek is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the fiscal year ending June 30, 1899, is $29,000.

Money statement.

July 1, 1898, balance unexpended	$4,805.74
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	9,805.74
June 30, 1899, amount expended during fiscal year	2,269.27
July 1, 1899, balance unexpended	7,536.47
July 1, 1899, outstanding liabilities	2,449.82
July 1, 1899, balance available	5,086.65
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—		By act approved July 13, 1892	$5,000
June 14, 1880	$5,000	By act of August 18, 1894	[1] 5,000
March 3, 1881	10,000	By act of June 3, 1896	5,000
By act passed August 2, 1882	5,000	By act approved March 3, 1899	5,000
By act approved August 5, 1886	10,000		
By act of August 11, 1888	5,000	Total, present project	20,000
Total	35,000	Aggregate	55,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, ice, ship timber, etc	7,150	$12,262
Fertilizers, sawed lumber, etc	6,162	68,875
General merchandise	2,000	80,000
Total	15,312	161,137
Shipments: Fruits, flour, meal, lumber, etc	10,356	61,924
Total receipts and shipments	25,668	223,061

Vessels trading in Broad Creek, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	80	6	3 trips weekly.
Schooners	6	440	7 to 8	Twice a month.
Do	6	280	5 to 7	Monthly.

One schooner, 200 tons register, built, and vessels of a total of 1,060 tons repaired during the year.

The above statistics were obtained by Mr. John R. Beckett, inspector, United States Engineer Department, and submitted with the following letter:

LAUREL, DEL., *March 13, 1899.*

SIR: I have the honor herewith to inclose commercial statistics for Broad Creek River, Delaware. They are as correct as I can get them, and fairly represent the commerce by water during 1898.

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[1] This appropriation was applied to removing bar on Nanticoke River, under the terms of the appropriation.

Owing to improved water communication, the railroad company, in order to compete, have greatly reduced freight rates to this point, and at least two-thirds if not more of the commerce of the town of Laurel is carried by rail.

With great respect, your obedient servant,

JOHN R. BECKETT, *Inspector.*

Gen. WILLIAM F. SMITH,
United States Agent.

I 14.

IMPROVEMENT OF NANTICOKE RIVER, DELAWARE AND MARYLAND.

For previous history, see Annual Report of the Chief of Engineers for 1899, Part I, page 197.

The amount expended on the improvement of this river to June 30, 1898, was $5,184.12, of which $184.12 was expended on the present project.

The first appropriation on the project was that of $3,000 made by the river and harbor act of June 3, 1896. Dredging to be done therewith was included in a contract dated December 24, 1896, for dredging on rivers and harbors along the eastern shore of Chesapeake Bay, the entire work to be completed by June 30, 1898. As this improvement was not reached by the time stipulated, the time was, by authority of the Chief of Engineers, extended for a period of six months.

Dredging was begun on September 12, 1898, and completed October 25, 1898. The channel above the railroad bridge was widened and deepened to near the county bridge at Seaford, a distance of 1,650 feet. The depth made was 9 feet at mean low water, and the width, starting with 100 feet at the lower end, was gradually increased to a maximum of 230 feet near the county bridge, measured from the wharves there across the river. Below the railroad bridge the channel was dredged to the approved dimensions for a distance of 1,800 feet, covering the "middle ground" abreast of the wharves, and about 2,500 feet below the lower end of the "middle ground" a sharp turn in the channel was removed. The base of the cut made there was 650 feet long. The quantity of material dredged was 20,765 cubic yards and consisted of sand and mud, some of the sand being quite hard. This was scowed away and deposited in the river below Cannons Ferry in 22 feet of water. The result of these operations gives a channel of the approved dimensions between the railroad and county bridges and down to deep water below, except in a bend about 2,900 feet below the railroad bridge, where, on account of a sharp turn, the channel remains to be widened.

Nanticoke River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1898, balance unexpended	$2,815.88
Amount appropriated by river and harbor act approved March 3, 1899	3,000.00
	5,815.88
June 30, 1899, amount expended during fiscal year	2,805.03
July 1, 1899, balance unexpended	3,010.85
July 1, 1899, outstanding liabilities	197.27
July 1, 1899, balance available	2,813.58

AMOUNTS APPROPRIATED.

By act of June 3, 1896	$3,000
By act approved March 3, 1899	3,000
Total	6,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Raw bone, phosphate, ship timber, etc	266	$5,514
Fertilizers, flour, lumber, etc	3,611	79,582
Cattle, horses, hay, etc	595	27,901
General merchandise	1,025	41,000
Total	5,497	153,997
Shipments:		
Canned goods, basket and barrel material, etc	3,034	155,581
Berries, peaches, grain, poultry, etc	8,594	309,613
General merchandise	996	39,840
Total	12,624	505,034
Total receipts and shipments	18,121	659,031

Vessels trading in Nanticoke River, Delaware and Maryland.

Class.	No.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	459	6	Triweekly.
Schooners and sloops	Unknown.	1,200	5 to 7	Grain, lumber, and fertilizers.

Sailing vessels of an aggregate of 700 tonnage repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 15.

IMPROVEMENT OF WICOMICO RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 199.

The amount expended by the General Government for the improvement of this river, on the present project, to June 30, 1898, was $19,601.80.

On December 24, 1896, a contract was made for dredging on this and other improvements on the eastern shore of Chesapeake Bay, the entire work to be completed by June 30, 1898. The contractor not having reached this work by the stipulated time, he was, by authority of the Chief of Engineers, granted an extension of six months.

On July 13, 1898, dredging was begun under this contract abreast of Williams Point and carried on in a down-river direction to Goose Island Wharf, a distance of about 2,750 feet, the channel being made 100 feet wide and 9 feet deep at mean low water. Operations were then resumed above Williams Point, where the channel previously dredged had narrowed and shoaled considerably, and six cuts, 25 feet wide and aggregating 2,925 feet in length, were dredged to the approved depth. This completed the dredging that could be done with the appropriation, and the contract for this improvement was closed September 9, 1898. The quantity of material removed was 28,209 cubic yards, and consisted of sand and mud, with some gravel, which was scowed away and deposited in 20 feet of water about 4 miles down the river.

The dredging covered by the project has been completed, but an examination of the river, made upon the completion of these operations, showed that owing to the shoaling of the channel during the progress of the work the dredging of about 41,200 cubic yards would be necessary to restore it to the project dimensions. The estimate submitted herewith is for the dredging now required on that account, no provision for maintenance having been made in the original estimate.

Wicomico River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1898, balance unexpended	$3,598.20
June 30, 1899, amount expended during fiscal year	3,328.22
July 1, 1899, balance unexpended	269.98
July 1, 1899, outstanding liabilities	269.98
Amount (estimated) required for completion of existing project	6,798.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	6,798.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act of—

June 10, 1872	$5,000
March 3, 1873	5,000
June 28, 1874	5,000
March 3, 1875	5,000
August 14, 1876	5,000
June 18, 1878	5,000
March 3, 1879	3,000
June 14, 1880	5,000
March 3, 1881	2,000
July 5, 1884	10,000
Total	50,000
September 19, 1890	10,000
July 13, 1892	6,500
August 18, 1894	3,000
June 3, 1896	3,700
Total on present project	23,200
Aggregate	73,200

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, phosphate rock, oysters, etc	5,788	$78,516
Fertilizers, flour, dressed lumber, etc	86,751	676,618
Horses, cattle, grain, etc	1,098	36,394
General merchandise	95,444	293,280
Total	189,081	1,084,808
Shipments:		
Coal and wood	7,075	12,750
Canned goods, fertilizers, bricks, etc	28,263	310,622
Corn, wheat, fruit, etc	3,834	170,822
General merchandise	30,067	1,202,480
Total	69,259	1,696,674
Total receipts and shipments	259,340	2,781,482

Vessels trading in Wicomico River, Maryland.

Class.	No.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	704	5½	Triweekly.
Schooners	14	990	5½ to 8½	Weekly.
Schooner	1	660	8	Monthly.
Do	1	400	8	Bimonthly.
Do	1	300	8	Occasionally.

Fifty sailing vessels, of an aggregate of 1,600 tonnage, repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company, and the Hon. E. Stanley Toadvin, of Salisbury, Md.

I 16.

IMPROVEMENT OF MANOKIN RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 200.

Nothing has been done on the improvement during the past fiscal year, but work will be resumed in the course of a few days at the mouth and in dredging in the river between Dashiells Creek and a point known as the Red Bridge, or county wharf, under a contract now in operation. The amount expended to June 30, 1898, is $18,975.

The river and harbor act of March 3, 1899, appropriated $1,500 for continuing the improvement, and it is expected that a contract for dredging, embracing this and other improvements along the Eastern Shore of Chesapeake Bay, will be made soon.

It was impracticable to obtain commercial statistics.

Manokin River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1898, balance unexpended		$4,025.00
Amount appropriated by river and harbor act approved March 3, 1899		1,500.00
July 1, 1899, balance unexpended		[1]5,525.00
July 1, 1899, amount covered by uncompleted contracts		4,000.00
July 1, 1899, balance available		1,525.00
Amount (estimated) required for completion of existing project		7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$4,000.00	
For maintenance of improvement	600.00	
		4,600.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	$7,500
July 13, 1892	7,500
Act of August 18, 1894	4,000
Act of June 3, 1896	[1]4,000
By act of March 3, 1899	1,500
Total	24,500

CONTRACT IN FORCE.

With Chester T. Caler, of Norfolk, Va., for dredging, approved January 5, 1897. Expires, as extended, August 31, 1899.

I 17.

IMPROVEMENT OF POCOMOKE RIVER, MARYLAND, BELOW SNOW HILL.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 200.

The amount expended on this improvement to June 30, 1898, was $24,987.26, of which $4,487.26 was on the present project.

No work has been done on the improvement during the past fiscal year.

The river and harbor act of March 3, 1899, appropriated $3,000 for continuing this improvement, and it is expected that a contract for dredging, embracing this and other improvements along the eastern shore of Chesapeake Bay, will be made soon.

It is proposed to expend the amount asked for, if appropriated, in dredging the channel to the full width and depth in accordance with the project.

Pocomoke River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

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[1] Of this amount $2,000 is for work in the upper river not covered by the project.

Money statement.

July 1, 1898, balance unexpended		$512.74
Amount appropriated by river and harbor act approved March 3, 1899		3,000.00
July 1, 1899, balance unexpended		3,512.74
July 1, 1899, outstanding liabilities		373.63
July 1, 1899, balance available		3,139.11
Amount (estimated) required for completion of existing project		6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$4,000.00	
For maintenance of improvement	500.00	
		4,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved—		
June 18, 1878		$10,000.00
March 3, 1879		2,500.00
August 5, 1886		8,000.00
Total		20,500.00
By act of June 3, 1896	$5,000.00	
By act approved March 3, 1899	3,000.00	
Total on present project		8,000.00
Aggregate		28,500.00

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, dimension stone, ice, etc	1,271	$7,218
Fertilizers, flour, millwork, etc	2,789	79,903
Cattle, hogs, horses, etc	622	20,046
General merchandise	15,250	610,000
Total	19,932	717,167
Shipments:		
Cord wood, logs, ship timber, etc	1,979	29,158
Canned goods, crates, lumber, etc	19,387	312,807
Fruit, grain, eggs, etc	4,444	266,792
Total	25,810	608,757
Total receipts and shipments	45,742	1,325,924

Vessels trading in Pocomoke River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Passenger and freight steamer	1	654	6½	Semiweekly.
Schooners and sloops	Unknown.	6,610	5 to 7	Grain, lumber, fertilizers, etc.

Schooners, sloops, barges, and bugeyes of an aggregate tonnage of 4,600 built and repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 18.

IMPROVEMENT OF QUEENSTOWN HARBOR, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1899, Part I, page 201.

The amount expended on this improvement to June 30, 1898, was $17,288.73, of which $14,000 was on previous projects.

No work has been done during the past year.

Queenstown is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended	$1,237.52
July 1, 1899, outstanding liabilities	200.00
July 1, 1899, balance available	1,037.52

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1871	$5,000
June 10, 1872	6,000
March 3, 1879	3,000
Total	14,000
By act of June 3, 1896	5,000
Aggregate	19,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1898.

Traffic.

	Tons.
Per Chester River Steamboat Company	2,447
Per Queen Anne R. R. Co.'s boats	23,398

Vessels trading in Queenstown Harbor, Maryland.

The Chester River Steamboat Company's steamer *Emma A. Ford*, 533 registered tonnage, makes daily trips five months in the year, and then triweekly. The Queen Anne Railroad steamer *B. S. Ford* has a registered tonnage of 417 tons.

I 19.

IMPROVEMENT OF ROCKHALL HARBOR AND INNER HARBOR, AT ROCKHALL, MARYLAND.

For previous history, see Annual Report of the Chief of Engineers for 1899, Part I, page 201.

The amount expended on this improvement to June 30, 1898, was $15,451.38.

No work has been done during the past fiscal year. The expenditure reported was for outstanding liabilities.

It was impracticable to obtain complete commercial statistics.

Rockhall is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1899, is $2,100,792.77.

Money statement.

July 1, 1898, balance unexpended	$1,148.62
June 30, 1899, amount expended during fiscal year	50.00
July 1, 1899, balance unexpended	1,098.62
July 1, 1899, outstanding liabilities	1,098.62

AMOUNT APPROPRIATED.

By act of June 3, 1896	$16,600

I 20.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wrecks of barges J. E. Gillingham and Wm. E. Weller.—At the close of last fiscal year work on the removal of the wreck *J. E. Gillingham* was in progress, and this continued until July 4, 1898, when it was completed. The wreck was blown up with dynamite, and the débris removed and placed ashore above high water. The entire cost of removal, including inspection, etc., was $862.52. The authority of the War Department, dated April 18, 1898, for the removal of the wreck *Wm. E. Weller*, was granted with the condition that the wreck was not to be removed "until after the present crisis has passed, unless the interest of our own commerce and the safety of our own vessels should demand earlier removal." The wreck had been buoyed and neither our vessels nor the interests of our commerce were endangered by delaying the work of removal. It was later reported that the wreck was sinking into the muddy bottom, and soundings made over it on November 21, 1898, under the direction of Commander Charles M. Thomas, United States Navy, light-house inspector of the Fifth District, showed that there was 6 feet of water over the top of the deck house and about 10 feet over the rest of the wreck. Under these circumstances, by authority of the Chief of Engineers, no further action has been taken in the matter.

Wreck of scow sunk at Rothwell's Landing, in Smyrna River, Delaware.—Operations for the removal of this wreck were in progress at the close of last fiscal year, and these were continued to July 7, 1898, when they were completed. The holes and leaks in the wreck were temporarily closed up, the water pumped out, and the vessel floated and hauled away to behind the island at the upper end of the canal, well up against the marsh, where it was scuttled about 250 feet from the nearest point of the channel and entirely out of the way of navigation, upon a flat that runs bare at low tide. The entire cost was $185.38, the original allotment of $150 for the work having been increased to that amount to cover the actual cost.

Wreck of pungy Cornelia Ann.—Under date of January 25, 1899, the collector of customs at Crisfield, Md., reported to the Secretary of the Treasury that there was an old wreck in the harbor of Crisfield which was a menace to navigation. Upon an examination, by direction of the Chief of Engineers, the wreck referred to was found to be the pungy *Cornelia Ann*, a schooner-rigged wooden vessel of 23 tons burden, 50 feet long, 17 feet beam, and 5 feet deep, which was sunk in the winter of 1892–93 along the wharf near the ice manufacturing plant at Crisfield. The wreck was lying in 9 feet of water at low tide, and a menace to navigation, as reported by the collector. The Chief of Engineers having authorized its removal and allotted $275 for the purpose, proposals were advertised for, and as the lowest bid received was $325, they were rejected as excessive, and arrangements made in open market for the work with Charles W. Johnson, who had bid $325 at the opening of the formal proposals to do the work. Operations thereon were begun on April 24 and completed April 27, 1898. The deck and upper portions of the wreck having been carried away, only the lower part of the hull was left to be removed. The stern post, keel, stem, and ribs, with parts of the old sheathing, were blown up, and all the pieces hoisted upon the deck of a schooner and carried up stream and deposited back of an old wharf. The wreck was entirely removed, at a cost of $266.72, including advertising, inspection, etc. Soundings taken after the completion of the work showed not less than 8 to 10 feet of water at the locality at low tide.

Abstract of proposals received by Gen. William F. Smith, United States agent, and opened April 6, 1899, for removing the wreck of the pungy Cornelia Ann, in Crisfield Harbor, Maryland.

No.	Name and address of bidder.	Time to commence (days after award).	Time to complete (days).	Amount.
1	W. H. French, Norfolk, Va	10	60	$440
2	Charles W. Johnson, Lewes, Del	5	15	325
3	Louis E. Brown, Baltimore, Md	10	30	600

These bids were rejected as excessive.

I 21.

ESTABLISHMENT OF HARBOR LINES IN ANNAMESSEX RIVER AT CRISFIELD, MARYLAND.

BALTIMORE, *May 19, 1898.*

DEAR SIR: I address you as counsel to the commissioners of the town of Crisfield, on the Eastern Shore of Maryland, in relation to a matter relating to the navigation of the harbor at that town. I desire to call your attention to the fact that during the time that the Hon. George R. Dennis was Senator from Maryland, somewhere about 1873–74 perhaps, the Congress of the United States appropriated $10,000 or $20,000 for the improvement of this harbor.

The trade of the town is quite considerable in fish, crabs, and oysters. The oyster trade here is second only to that of Baltimore. The business done in crabs exceeds that of any town in the world. Some firms ship as much as 2,000 dozen of soft crabs per day. Large vessels from New England and elsewhere come into this port with cargoes of ice, lumber, etc. Its trade is mostly a water trade and deserves the fostering care of the Government. In 1872 the legislature passed an act, chapter 409 of that session, to define and preserve the harbor of Crisfield and the Little Annemessex River in Somerset County. By it three persons were appointed as commissioners to make the survey and establish lines. They did so and their report was modified and then ratified by the circuit court, according to the terms of the act. The sixth section of the act reads as follows:

> That after the said report or amended report shall be recorded as aforesaid, it shall not be lawful to build or erect any wharf, pier, improvement, or any structure of any kind in the said river or cove or extend the same from either shore, beyond or outside the building line established as aforesaid; and if any person shall unload, discharge, or throw overboard any ballast, shells, stones, earth, or other matter in the said harbor defined as aforesaid, or shall fill up and obstruct the navigation of the same, he or she shall be guilty of a public nuisance, and on indictment and conviction be punished by fine at the discretion of the court, until fines and costs are paid.

Nothing is said about the right to build within the lines, except in the first section, which authorizes the commissioners "to survey the said river and define and establish lines on both sides of said river and cove, to which wharves and other improvements from either shore may be made and erected." The third section says:

> That they shall cause a plat, an accurate delineation thereof, to be made, and shall establish a building line on both sides of the said river and cove, and shall cause the same to be accurately delineated and defined and laid down on the said plat and particularly described in the explanations to be annexed to their plat.

In making the survey the commissioners followed out pretty well the spirit of the act, and only deviated in one particular. The railroad company had erected a pier out into the Annamessex River at a point where the channel and deeper water was 400 to 500 yards wide. They extended this pier nearly across that channel, leaving not more than 75 or 100 yards between the end of it and the opposite shore and not confining themselves, as by the act they were bound to do, to the near side of the river, but actually going across to the other side. At the end of the said pier there was a large depot building, used for joint purposes of the railroad and connecting steamboat lines, and to the north and west there extended from the foot of the pier a swing, forming a structure like the capital letter L. The report of the commission recommended that the wing, which lay to the north and west of the depot structure, be included in the harbor, and that the structure be removed. The counsel for the railroad arose in his place at the bar and said that while the railroad company admitted that the L was an obstruction to navigation, yet he did not desire to be compelled to take it up, but that for the company he would make a pledge that that part of the pier should never be repaired, but should be allowed to go to decay in the natural course of things, and that when decayed it should not be renewed. The court said that they had some doubt about the authority of the legislature to pass an act compelling the railroad company to remove a structure which they (the court) thought was lawfully erected, and they very gladly accepted the pledge of the counsel and modified the report so as to exclude the L from the navigable waters of the harbor.

The railroad company kept its pledge. It did not repair this part of the wharf, it did not renew it, but suffered it to go to decay, and now the covering is entirely gone and only the tops of the piling at low water can be seen. There is, however, about 15 or 20 feet of it immediately adjoining the depot which has lately been put in order, contrary to this pledge. I should state that the original railroad company which made the pledge has gone out of existence. The counsel who made it for the company is dead, and the property and franchise have been for some time in the hands of the New York, Philadelphia and Norfolk Railroad Company. As long as Mr. Crisfield was its counsel the pledge made by the original company was kept by the present owners in entire good faith. During the past winter the commissioners requested their counsel to endeavor to change the law in regard to this L so as to include it within the harbor as navigable water, but the railroad company was able to bring to bear influences in the disturbed condition of the Maryland legislature that were more powerful than the wishes of the public of the rights of navigation and the bill was defeated. There is but one sentiment in Crisfield and vicinity among those who go down to the sea in ships at that point, that the L is a gross and outrageous obstruction to navigation. The commissioners and inhabitants of the town are greatly desirous of having it removed, and it ought to be removed.

Under the act of Congress approved September 19, 1890, as amended by section 3 of the river and harbor act approved July 13, 1892, jurisdiction in this matter seems to be conferred upon the Secretary of War in relation to such matters. He is authorized to notify the United States district attorney, who shall institute criminal proceedings for such obstruction, or through the Attorney-General proper proceedings in equity for the removal of such obstructions may be instituted. After the attempt and failure to pass the act last winter at the last session of the legislature, the railroad company boldly announced that it intended to drive new piling and erect a new superstructure upon the wing or L complained of. I am aware that there may be some difficulty in reference to proceeding, because a superstructure upon the point complained of would at first sight seem to be authorized by the act of 1872 of the Maryland legislature, but I do not think that this act contemplated that the harbor lines should both be drawn on one side of the channel, and even if it were, I do not think that the legislature of Maryland could in this way obliterate a channel or compel the United States in improving the harbor to go over to the other side of the harbor and dig out the natural bars outside the channel in order to make a new channel.

I inclose a roughly-drawn map[1] of the place complained of, but you will, doubtless, find every particular in the report of the engineer who surveyed the harbor at the time it was dug out by the United States Government.

I, therefore, desire earnestly to appeal to you to put the matter in the hands of the Attorney-General or the district attorney for Maryland, whichever in your judgment shall be the proper one, so that if possible the navigation of the Annamessex River and the harbor of Crisfield may be preserved to the sailors and vessels which have a right to use them, or if deemed more proper and desirable by you the commissioners of Crisfield would respectfully invite you, under section 12 of the act of Congress (1892), to establish new harbor lines for said harbor, so as to determine whether the L shall be built upon or not.

I am, most respectfully, your obedient servant,

THOS. S. HODSON,
Counsel to the Commissioners of Crisfield.

Hon. RUSSELL A. ALGER,
Secretary of War.

[Tenth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 11, 1898.

Respectfully referred to Brig. Gen. P. C. Hains, United States Volunteers, colonel, Corps of Engineers, Division Engineer, Southeast Division.

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[1] Not printed.

General Hains will please proceed to Crisfield, Md., and personally investigate this complaint, examine the wharf, and then return to his station in Baltimore, and submit, through the Chief of Engineers, his views and recommendations as to what action, if any, should be taken by the War Department.

The travel enjoined is necessary for the public service.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Eleventh indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., October 15, 1898.

Respectfully returned to the Chief of Engineers, U. S. A.

Having made a personal inspection of the wharf and its environs, I have to report that the wharf as it now exists, without the branch of the L, is an obstruction to navigation, and it should never have been allowed to be built. It was evidently built originally to accommodate the railroad and without much consideration of prospective demands of commerce. It projects diagonally out in the stream in prolongation of the railroad track, which follows a straight line down the main street of the town. It obstructs the flow of a large portion of the water in the river, producing a swift current in the gorge between it and the opposite shore.

While I was in Crisfield I saw no less than seven vessels—three schooners and four smaller vessels—beat downstream against an unfavorable tide and wind. The obstructive nature of the wharf was therein demonstrated. If the tide or wind had been stronger they could not have worked past the wharf at all. Nearly all the trade on this stream is carried in small sailing vessels, and many of them have to pass through the narrow gorge between the end of the wharf and the opposite side of the river.

The only question that seems to need consideration is, what is best to be done, under the circumstances, in order to preserve and protect the harbor and at the same time act fairly toward the railroad company, which constructed its wharf under the authority of the State, at that time deemed sufficient, and which the United States has allowed to continue in existence for more than a quarter of a century without objection, so far as I am informed.

In my opinion, the branch of the L, which has been allowed to go to decay, should not be rebuilt, and the old piling should be removed. There are two ways in which this can be accomplished. One is suggested in the fourth indorsement, and the second is by the Secretary of War establishing harbor lines under his authority to do so, conveyed by section 12 of the river and harbor act approved September 19, 1890, as amended by section 3 of the river and harbor act approved July 13, 1892.

There can be no doubt that the reconstruction of the branch of the L referred to will be an injury to the harbor. I would therefore recommend that the Secretary of War establish as the harbor lines those indicated by the full red lines on tracing herewith (sheet 2), made in the United States Engineer Office, Wilmington, Del. The branch of the L being then outside the harbor lines duly established, its reconstruction can only be done after plans for the same have been approved by the Secretary of War, and this approval can be withheld. The small part of the L, which has already been rebuilt, to remain as it now exists, but not to be repaired or rebuilt.

PETER C. HAINS,
Colonel, Corps of Engineers, and Brigadier-General Volunteers,
Division Engineer, Southeastern Division.

[Twelfth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 18, 1898.

Respectfully returned to the Secretary of War.

These papers relate to the wharf of the New York, Philadelphia and Norfolk Railroad in the harbor at Crisfield, Md.

Acting under instructions of the Secretary of War as contained in the ninth indorsement, and by his authority orally given, these papers were referred to Gen. Peter C. Hains for examination and report. This duty has been performed by General Hains, and his report on the subject is contained in the foregoing (eleventh) indorsement. He states that the wharf, as it now exists without the branch of the L, is an obstruction to navigation and it should never have been allowed to be built. He further states that there can be no doubt that the reconstruction of the branch of the L referred to will be an injury to the harbor, and therefore recommends that the Secretary of War establish as harbor lines those indicated by the full red lines on tracing[1] herewith (sheet 2) made in the United States Engineer Office at Wilmington, Del. The branch of the L, he remarks, being then outside the harbor lines duly established, its reconstruction can only be done after plans for the same have been approved by the Secretary of War, and this approval can be withheld, the small part of the L which has already been rebuilt to remain as it now exists, but not to be repaired or rebuilt.

A. MACKENZIE,
Acting Chief of Engineers.

[Thirteenth indorsement.]

WAR DEPARTMENT, *June 10, 1899.*

Approved as recommended by General Hains in the eleventh indorsement hereon.

G. D. MEIKLEJOHN,
Acting Secretary of War.

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[1] Not printed.

APPENDIX J.

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, COL. PETER C. HAINS, CORPS OF ENGINEERS, AND LIEUT. CHARLES W. KUTZ, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Patapsco River and channel to Baltimore, Md.
2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland
3. Harbor of Southwest Baltimore (Spring Garden), Maryland.
4. Removing sunken vessels or craft obstructing or endangering navigation.

HARBOR LINES.

5. Patapsco River, at Sparrows Point, Maryland.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 20, 1899.

GENERAL: I have the honor to forward herewith the annual reports for the year ending June 30, 1899, for the works of improvement of rivers and harbors in my charge.

Very respectfully, your obedient servant,

PETER C. HAINS,
Colonel, Corps of Engineers, U. S. A.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE, MARYLAND.

No dredging has been done in the fiscal year, the contract with the Virginia Dredging Company having been completed June 30, 1898, although the final payment on the contract was not made until July 13, 1898.

Under the law of March 3, 1899, a contract for dredging has been awarded to Simon Hess, involving $1,000,000, the contract price being

8.33 cents per cubic yard, the material to be dumped in the bay. This contract has not yet been approved, but if it be, work will be commenced soon thereafter.

The United States steam tender *Sentinel*, belonging to this improvement, has been in commission a part of the fiscal year on fortification work, the steam tender *Runaway* being laid up.

Money statement.

July 1, 1898, balance unexpended	$70,140.72
Amount appropriated by river and harbor act approved March 3, 1899.	200,000.00
	270,140.72
June 30, 1899, amount expended during fiscal year	51,215.99
July 1, 1899, balance unexpended	218,924.73
July 1, 1899, outstanding liabilities	200.00
July 1, 1899, balance available	218,724.73
Amount (estimated) required for completion of existing project	1,900,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	300,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following are the amounts and dates of appropriations for improving harbor at Baltimore, Md., including Patapsco River:

August 30, 1852	$20,000
August 15, 1856	100,000
June 28, 1864	20,000
June 23, 1866	5,200
March 3, 1867	75,000
July 25, 1868	17,000
April 10, 1869	26,730
July 11, 1870	42,900
March 3, 1871	50,000
June 10, 1872	100,000
March 3, 1873	200,000
June 23, 1874	75,000
March 3, 1875	75,000
August 14, 1876	75,000
June 18, 1878	75,000
March 3, 1879	160,000
June 14, 1880	$100,000
March 3, 1881	150,000
August 2, 1882	450,000
July 5, 1884	250,000
August 5, 1886	150,000
August 11, 1888	300,000
September 19, 1890	340,000
March 3, 1891	151,200
August 5, 1892	208,000
August 18, 1894	50,000
June 3, 1896	400,000
June 3, 1896	50,000
March 3, 1899	200,000
Total	3,916,030

Abstract of proposals for dredging channel leading to harbor at Baltimore, Md., opened at noon of May 18, 1899, by Col. Peter C. Hains, Corps of Engineers.

No.	Name and address of bidder.	Price per cubic yard.	Total for 10,000,000 cubic yards (estimated quantity).
		Cents.	
1	Baltimore Dredging Company, Baltimore, Md	9.6	$960,000
2	Morris & Cumings Dredging Company, New York, N. Y	10.1	1,010,000
3	American Dredging Company, Philadelphia, Pa	9.9	990,000
4	Virginia Dredging Company, Richmond, Va	10.1	1,010,000
5	Simon Hess, New York, N. Y	8.33	833,000
6	Christie, Lowe & Heyworth, Chicago, Ill	9.2	920,000

Contract with Simon Hess.

COMMERCIAL STATISTICS.

Commercial statistics of the port of Baltimore, Md., comparing the fiscal years ending June 30, 1898 and 1899.

[Compiled for the use of Col. Peter C. Hains, Corps of Engineers.]

IMPORTS.

	Free.	Dutiable.	Total.
1898	$5,036,777	$3,868,426	$8,905,203
1899	4,636,021	4,515,138	9,151,159
Increase in 1899	*a* 400,756	646,712	145,956

a Decrease.

In American vessels in 1899:	
Sailing	$1,352,683
Steam	70,421
In foreign vessels in 1899:	
Sailing	206,614
Steam	7,502,722
In cars overland	18,719
Total	9,151,159

DOMESTIC EXPORTS.

1898	$118,782,172
1899	107,099,201
Decrease in 1899	11,682,971
In American vessels in 1899:	
Sailing	994,280
Steam	31,155
In foreign vessels in 1899:	
Sailing	273,026
Steam	105,800,740

Recapitulation.

In American vessels in 1899	$1,025,435
In foreign vessels in 1899	106,073,766
Total exports in 1899	107,099,201

Principal articles exported.

	Tons.		Tons.
Cattle	35,105	Beef products	17,357
Grain	1,522,710	Pork products	36,487
Flour	294,958	Lard	48,640
Coal	234,764	Oleomargarine	17,970
Copper	36,798	Starch	14,044
Cotton, unmanufactured	52,800	Rosin	23,248
Glucose	23,930	Tobacco	37,670
Iron, and manufactures of	121,787	Wood, and manufactures of	207,517
Oil cake	62,904	Oils	146,540

Amount of duties collected in 1899	$1,997,860.83
Miscellaneous customs receipts in 1899	102,931.94
Total receipts in 1899	2,100,792.77
Total receipts in 1898	1,780,253.99
Increase in 1899	320,538.78
Duties on merchandise in bond in 1898	213,654.68
Duties on merchandise in bond in 1899	238,641.05
Increase in 1899	24,986.37

Summary of duties collected in 1899.

Imports and miscellaneous customs receipts	$2,100,792.77
Merchandise in bond	238,641.05
Merchandise transported with appraisement	35,316.32
Total	2,374,750.14

Statistical recapitulation.

Duitable imports have increased	$646,712.00
Free imports have decreased	$400,756.00
Domestic exports have decreased	$11,682,971.00
Tonnage (foreign) has decreased ... tons	49,271.00
Duties collected have increased	$319,938.10
Duties on merchandise in bond have increased	$24,986.37
Duties on merchandise in bond with and without appraisement have increased	$138,795.67

Tonnage movement.

	Number of vessels.		Tonnage.	
	1897-98.	1898-99.	1897-98.	1898-99.
Foreign trade:				
Entered	1,043	893	1,654,361	1,605,090
Cleared	1,099	941	1,824,970	1,729,202
Coasting trade:				
Entered	1,521	1,332	1,843,764	1,473,401
Cleared	2,107	1,987	2,126,982	2,035,927

Number of immigrant passengers arrived.

	Male.	Female.	Total.
1897-98	7,027	5,042	12,069
1898-99	10,296	5,255	15,551

Vessels built, 1898-99.

	Number.	Gross tonnage.	Net tonnage.
Steam	12	1,094	661
Sail	15	1,519	1,470
Total	27	2,613	2,131

Established lines of steamships.

	Number.	Tons.	Destination.
Johnston Line	6	27,263	Liverpool.
Atlantic Transport Line	10	21,002	London.
North German Lloyd	16	51,191	Bremen.
Blue Grass Line	1	2,979	Havre.
Buckman Line	5	2,866	Jamaica.
Neptune Line	8	15,392	Rotterdam.
Donaldson Line	8	20,479	Glasgow.
Lord Line	10	22,433	Belfast and Dublin.
Puritan Line	5	11,203	Antwerp.
Monumental Trading Co	1	523	Jamaica.
Hamburg-American Line	24	76,316	Hamburg.
Empire Line	8	4,660	Leith.
Earn Line	5	8,288	Cuban ports.

New lines: Earn Line reestablished 5 steamers to Cuban ports.

The following lines have reduced the number of vessels:

Johnston Line	3	Hamburg-American Line	2
Blue Grass Line	2		—
Empire Line	1	Total	9
Monumental Fruit Co	1		

The following lines have added to the number of vessels:

Atlantic Transport Line	1
Puritan Line	1

The tonnage movement at this port for the fiscal year ended June 30, 1899, shows a slight falling off (3 per cent) from last year. This is due entirely to the movement in cereals, which show a decrease in export of about 10,000,000 bushels. The export of grain last year was abnormal; with this exception the movement for this year exceeds that of any previous year. This slight falling off in tonnage movement indicates that we are not dependent upon fickle trade conditions in any one or more commodities or products. This is plainly shown in the increased carrying capacity of the vessels composing the established lines of steamships. The future of Baltimore was never more promising; the sudden impulse given to the shipbuilding interests by the reopening of the marine department of the Maryland Steel Company, which has already booked orders that will keep it busy for several years; the unusual activity at the Columbian Iron Works, where the books show work ahead for two years; the proposed mammoth dry dock by the William Skinner Dry Dock Company, the contract for which has been let, and the further fact that there is not a shipyard in Baltimore that is not full of work, show that Baltimoreans are keeping abreast of the great wave of prosperity that is irresistibly sweeping over the country from coast to coast. Our marine development is in its infancy, and should some such plan of ship subsidy be adopted along the lines of the Hanna-Payne bill introduced in the Fifty-fifth Congress, together with its twin proposition of a ship canal across Central America, connecting the waters of the Atlantic and Pacific, the shipyards of the United States, with their immense advantage in cheap raw material, will build ships for all the nations of the earth.

There are now 13 established lines of steamships trading at this port, embracing 102 vessels and having an aggregate carrying capacity of over 400,000 tons.

Respectfully, yours,

Wm. F. Stone, *Collector.*

Col. Peter C. Hains,
Colonel, Corps of Engineers.

J 2.

IMPROVEMENT OF CHANNEL TO CURTIS BAY, IN PATAPSCO RIVER, BALTIMORE HARBOR, MARYLAND.

No work was done in the fiscal year ending June 30, 1899.

Money statement.

July 1, 1898, balance unexpended	$12,000.00
July 1, 1899, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	45,000.00

The following are the amounts and dates of appropriations for improving channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland:

July 13, 1892	$28,000
August 18, 1894	12,000
Total	40,000

J 3.

IMPROVEMENT OF HARBOR OF SOUTHWEST BALTIMORE (SPRIN GARDEN), MARYLAND.

Nothing has ever been done on this work.

Money statement.

July 1, 1898, balance unexpended	$5,000.00
July 1, 1899, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	309,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following is the amount and date of appropriation for improving harbor of Southwest Baltimore (Spring Garden), Maryland:

June 23, 1896	$5,000

J 4.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Sunken scow.—A scow was sunk so as to obstruct the navigation through the draw in the bridge across Colgate Creek, near Baltimore, Md. The United States steam tender *Sentinel*, with a small force and the use of dynamite, removed the wreck in two days' work, at a total cost of $73.52.

J 5.

ESTABLISHMENT OF HARBOR LINES IN PATAPSCO RIVER AT SPARROWS POINT, MARYLAND.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., April 22, 1899.

GENERAL: I have the honor to inclose copy of letter received from the Maryland Steel Company, requesting the establishment of harbor lines around their property at Sparrows Point, Maryland, on the Patapsco River, about 7 miles below Baltimore, Md.

The town of Steelton and the extensive iron works of the Maryland Steel Company occupy Sparrows Point. All the property at the point is understood to be owned by the Maryland Steel Company, and it is the only property holder interested in the establishment of harbor lines there. This company is a large corporation, engaged in extensive operations with iron furnaces, steel-rail mills, shipbuilding plant, etc.

The pierhead line which they propose is shown in red on the accompanying tracing,[1] A, B, C, D, E; and the bulkhead line in blue, F, K, G, H, I. No harbor lines have ever been established at this point.

The Patapsco River is a tidal stream, but the average rise of tide is only 18 inches, so that no material decrease in the volume of the tidal prism would result from the establishment of the bulkhead line as desired by the Maryland Steel Company. Their pierhead line, 750 feet beyond the bulkhead line, seems, however, to encroach unnecessarily on the portion of the bay that is navigable by small sailing vessels. While the lines which they propose may not interfere with either the present or prospective requirements of navigation, nor with the rights of adjacent landowners, I am of the opinion that it will be unwise to place these lines so far out from the present shore line, unless it can be conclusively shown that it will advance the interests of both commerce and navigation.

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[1] Not printed.

The practice of building solid structures out to the pierhead line has been followed in the upper part of this harbor, and I see no objection to doing the same thing here. The present pier of the Maryland Steel Company is an open pile structure, but they wish to make it solid.

I would therefore recommend that the pierhead and bulkhead lines at this point be made coincident, and that they follow the lines F K J M I on the tracing. Beyond this limit no structures, either open or solid, could be built, but the wharves and piers within these lines could be made solid.

Very respectfully, your obedient servant,

PETER C. HAINS,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. Army.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY, *June 3, 1899.*

Respectfully submitted to the Secretary of War.

Colonel Hains forwards the accompanying request of the Maryland Steel Company for the establishment of harbor lines around their property at Sparrows Point, Maryland, on Patapsco River, and recommends that the lines laid down in blue upon the tracing herewith be approved.

Concurring in the views of Colonel Hains, I recommend that the lines selected by him be approved, and that the Secretary place his approval both upon the tracing which has been prepared for his signature, and upon this paper.

A. MACKENZIE,
Acting Chief of Engineers.

WAR DEPARTMENT, *June 6, 1899.*

Approved.

G. D. MEIKLEJOHN,
Acting Secretary of War.

APPENDIX K.

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, OF JAMES RIVER AND OF HARBOR AT MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN VIRGINIA ON THE WESTERN SHORE OF CHESAPEAKE BAY. PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

REPORT OF LIEUT. COL. CHAS. J. ALLEN, CORPS OF ENGINEERS, OFFICER IN CHARGE FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. **Potomac River at Washington, D. C.**
2. **Potomac River below Washington, D. C.**
3. **Occoquan Creek, Virginia.**
4. **Aquia Creek, Virginia.**
5. **Nomini Creek, Virginia.**
6. **Lower Machodoc Creek, Virginia.**
7. **Rappahannock River, Virginia.**
8. **Urbanna Creek, Virginia.**
9. **Milford Haven, Va.**
10. **York River, Virginia.**
11. **Mattaponi River, Virginia.**
12. **Pamunkey River, Virginia.**
13. **James River, Virginia.**
14. **Protection of Jamestown Island, Virginia.**
15. **Removing sunken vessels or craft obstructing or endangering navigation.**

SURVEY.

16. **Anacostia River, District of Columbia.**

HARBOR LINES.

17. **Potomac River at Washington, D. C.**

UNITED STATES ENGINEER OFFICE,
Washington, D. C., July 20, 1899.

GENERAL: I have the honor to forward herewith my annual report for the fiscal year ended June 30, 1899, for river and harbor works in my charge. * * *

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

K 1.

IMPROVEMENT OF POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1899.

At the commencement of the fiscal year dredging operations were in progress in the Virginia Channel above Long Bridge, by Mr. A. M. Clegg, with a hydraulic dredge. The dredge was, however, in bad order, so that it accomplished but little work. In July, 1898, the dredge worked but about 43 hours. During August the dredge was idle. On September 1 dredging was resumed, but much time was required for repairs, so that the actual running time for this month was but 174 hours, while the output for the month was 11,047 cubic yards, an average of about 63 cubic yards per engine hour. In October the dredge worked 153 hours and removed 7,788 cubic yards, an average output of 57 cubic yards per engine hour. The work of November reached 18,894 cubic yards, showing some improvement. During the last of November there was some delay from windy weather, and on November 27, 1898, under the influence of a high northwest gale, the tide fell to the unusual mark of 4 feet below zero or mean low tide.

The Potomac River froze over on December 14, and remained frozen until the 22d. During the month 12,072 cubic yards were dredged, and the quantity dredged in January, 1899, amounted to 12,128 cubic yards. The month of February, 1899, was notable for its severe winter weather. The river was frozen over and closed to navigation by the 9th. Unusually cold weather, with frequent snowstorms, followed, culminating in the remarkable snowstorm of February 12–13, when the snow fall amounted to 3 feet in depth. The thickness of the ice ranged from 6 to 10 inches. The river remained closed until the 19th, when the ice between the Long Bridge and the Aqueduct Bridge was broken up by tugs employed by the Commissioners of the District of Columbia, under a special appropriation of Congress. On February 22 the ice above the Aqueduct Bridge was broken up by tugs employed by this office. This ice passed out rapidly, and was immediately followed by the up-river ice, which ran for about two days following. There was no injury to the improvement, and while a strong current continued for several days, there was no marked rise in the river. Dredging operations were necessarily suspended during the greater part of February, the work of the month being 2,104 cubic yards.

The dredge which had been employed on the channel was taken out to the work on March 18, 1899, but was in such condition as to its boilers and machinery that it could not be effectively used. It, however, removed on March 28, 463 cubic yards.

Meanwhile Mr. Clegg had been engaged in the construction of a new dredge, which was brought to the Washington Channel on March 29, 1898, in an unfinished condition. During April the old dredge was operated until the 27th of the month when the new dredge was started. The work of both dredges for April amounted to 6,717 cubic yards. During May, 1899, with the new dredge alone, 15,101 cubic yards were dredged, while in June, 1899, the amount of dredging was 27,918 cubic yards. An examination of the channel, made in June, 1899, showed that the channel previously dredged by Mr. Clegg to 20 feet had shoaled to about 19 feet from freshet deposits, while the ruling depth over the bar in the part of the channel not dredged had decreased from about 17 to about 15 feet at low tide.

Mr. Clegg, under an extension of time granted by superior authority, was to complete the dredging in the Virginia Channel by October 1, 1898. The amount to be dredged was approximately 528,000 cubic yards. Mr. Clegg's time was further extended to April 1, 1899; then again to September 30, 1899. At the close of the fiscal year ended June 30, 1899, there remained about 420,000 to 440,000 cubic yards for Mr. Clegg to dredge by the close of the following September.

The wharf at Easbys Point, used for construction purposes, was extended to deeper water during the fiscal year.

DECISION IN THE POTOMAC FLATS CASE.

One of the most important events of the fiscal year relating to the improvement was the decision of the Supreme Court of the United States in the case of Martin F. Morris et al., appellants, *v.* United States, generally known as the Potomac Flats case, and which involved questions relating to the title of the land and water comprised within the limits of the improvement. The decision virtually sustained the contentions of the United States as to title, declaring the Kidwell and other claims on section I invalid, and confirming the title of the United States to the wharves on Water street, and removes all legal obstacles to the prosecution of the improvement.

AMOUNTS OF WORK DONE SINCE THE IMPROVEMENT WAS UNDERTAKEN.

The total number of cubic yards of material dredged from the channels from the commencement of the improvement (1882) to date, and deposited on the flats, is 10,813,221 cubic yards, as follows:

For the fiscal year ended June 30—	Cubic yards.
1883	200,000
1884	1,115,000
1885	1,085,000
1886	1,832,600
1887	1,081,500
1888	1,192,100
1889	1,088,300
1890	704,000
1891	282,500
1892	727,700
1893	156,500
1894	691,100
1895	524,700
1896	None.
1897	None.
1898	12,554
1899	119,667
Total	10,813,221

For convenience of designation and reference the reclaimed area has been divided into three sections, as follows:

Section I comprises the reclaimed area between Easbys Point and the sewer canal at the foot of Seventeenth street NW. Section II comprises the reclaimed area and the tidal reservoirs lying between the sewer canal and the Long Bridge. Section III comprises all of the reclaimed area below the Long Bridge lying between the Washington and Virginia channels.

AREAS.

Following is a summary of the areas of the several portions of the reclaimed area of the Potomac River improvement:

	Acres.
Total area (including reservoirs):	
Section I	134.81
Section II	277.08
Section III	327.53
Total area	739.42
Area of reservoirs:	
Large tidal reservoir	111.17
Small tidal reservoir	7.13
Total of reservoirs	118.30
Total area, as above	739.42
Deduct area of reservoirs	118.30
Total area of land	621.12

The total number of linear feet of sea wall built to date is 35,289, of which 4,910 linear feet have been taken down and relaid.

An appropriation of $100,000 was made by the act of March 3, 1899, for improving the Potomac River at and below Washington. Of this appropriation the sum of $74,000 was allotted for improving the Potomac River at Washington.

The items of work remaining to be completed are as follows: The dredging of the Virginia Channel and the raising of the remainder of the reclaimed area to the required height, the dredging of the tidal reservoir, the completion of the sea wall, the construction of the reservoir inlet, and the completion of the training dike on the right of the Virginia Channel above Long Bridge.

Five hundred linear feet of sea wall will have to be built at the northeast corner of the tidal reservoir in case the bathing beach shall ever be discontinued.

The sum of $300,000 can be profitably expended during the fiscal year ending June 30, 1901, in dredging the tidal reservoir, building the inlet gates, dredging the channels of the Potomac and depositing the dredged material, and extending the dike.

Maintenance.—The improvement has reached a stage where the maintenance and preservation of the reservation require attention. The growth of weeds and underbrush which, in the summer season especially, renders access to the various parts of the work difficult, should be cleared up each year until the reservation is ready to be laid out and graded. Annual repairs will also be needed on the wall and the reservoir gates.

The proper police supervision of this extensive area of 621 acres has also become a matter of importance. In order to prevent infractions of the law, trespasses, etc., the reservation should be patrolled by mounted men.

It is estimated that $3,000 will be required per annum for maintenance.

POTOMAC PARK.

Congress, by act of March 3, 1897, and in the following words, declared the reclaimed flats a public park:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the entire area formerly known as the Potomac Flats, and now being reclaimed, together with the tidal reservoirs, be, and the same are hereby, made and declared a public park, under the name of the Potomac Park, and to be forever held and used as a park for the recreation and pleasure of the people.

The reclamation of the flats has now reached a stage when it appears desirable, as it is practicable, to make a beginning upon the work of park improvement.

The greater part of the park area is composed of a rich alluvial soil, dredged from the bed of the river, and upon which a luxuriant growth rapidly appears. The dredging operations will continue to afford material of the same character, so that there will be sufficient for planting spaces.

The principal items of expense in the park development, therefore, will be the construction of drives and walks, and the drainage.

It is believed that the park should be made accessible to the public at an early day, and it is therefore suggested that a commencement be made by constructing a broad and commodious river drive bordered by wide bermes from the entrance to the park at the foot of Twenty-sixty street NW., along the river front of sections I and II, crossing the sewer canal and the reservoir inlet by bridging, continuing along the southeast margin of the reservoir to a crossing on truss or trestle bridge to be erected at a suitable distance above the present causeway bridge. This driveway, with its branch along the southeast margin, to be built at about the future grade of average filling proposed for the park, and which is several feet above the freshet line of 1889, requiring an embankment which can be made partly of material now in the park and partly of material to be dredged under operations for improvement of the Potomac at Washington. While a permanent roadway will be eventually required, it is not regarded as desirable to lay one at the outset on the new embankment, which should have time for settling. It is therefore proposed to place a temporary gravel covering, which material may serve as a subgrade for a future pavement, or for other purpose. Ample provision to be made for drainage along and through the driveway.

It is understood that the sewer canal at the foot of Seventeenth street is to be abolished as soon as the new sewer system is sufficiently advanced.

The estimated cost of the bridges, drainage, etc., and of the driveway and embankment above the plane considered in the present project—work under which is in progress—is placed at $135,000.

Plans for the development of the reclaimed flats into a park have been considered by this office ever since the inception, in 1881, of the project for their reclamation, and they have been kept in view since that time by the several officers of engineers who have had charge of the work. The officers have had, and this office still has, in this matter the valuable assistance of Mr. J. B. Duncklee, assistant engineer, a graduate of the Lawrence Scientific School at Harvard, and who is an able and experienced landscape and park engineer. Part of his experience was gained on parks in Brooklyn, N. Y., where he was engaged for six years under such eminent park authorities as Frederick Law Olmsted, John Bogart, and John Y. Culyer.

Washington is in the collection district of Georgetown, D. C. The nearest lighthouse is at Jones Point, Virginia.

Money statement.

July 1, 1898, balance unexpended		$98,239.64
Amount appropriated by river and harbor act approved March 3, 1899 (allotment)		74,000.00
		172,239.64
June 30, 1899, amount expended during fiscal year		19,957.93
July 1, 1899, balance unexpended		152,281.71
July 1, 1899, outstanding liabilities		4,300.00
July 1, 1899, balance available		147,981.71
Amount (estimated) required for completion of existing project		594,020.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$300,000.00	
For maintenance of improvement	3,000.00	
		303,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

August 2, 1882	$400,000
July 5, 1884	500,000
August 5, 1886	375,000
August 11, 1888	300,000
September 19, 1890	260,000
July 13, 1892	200,000
August 18, 1894	150,000
June 3, 1896	$100,000
March 3, 1899 (appropriated, $100,000; allotted Potomac River below Washington, $26,000)	74,000
Total	2,359,000

CONTRACT IN FORCE.

A. M. Clegg, dredging, dated March 9, 1897; approved March 16, 1897; date of commencement, July 1, 1897; date for completion, October 1, 1898; annulled March 7, 1898.

COMMERCIAL STATISTICS.

[Furnished by Mr. J. W. Averill, Washington, D. C.]

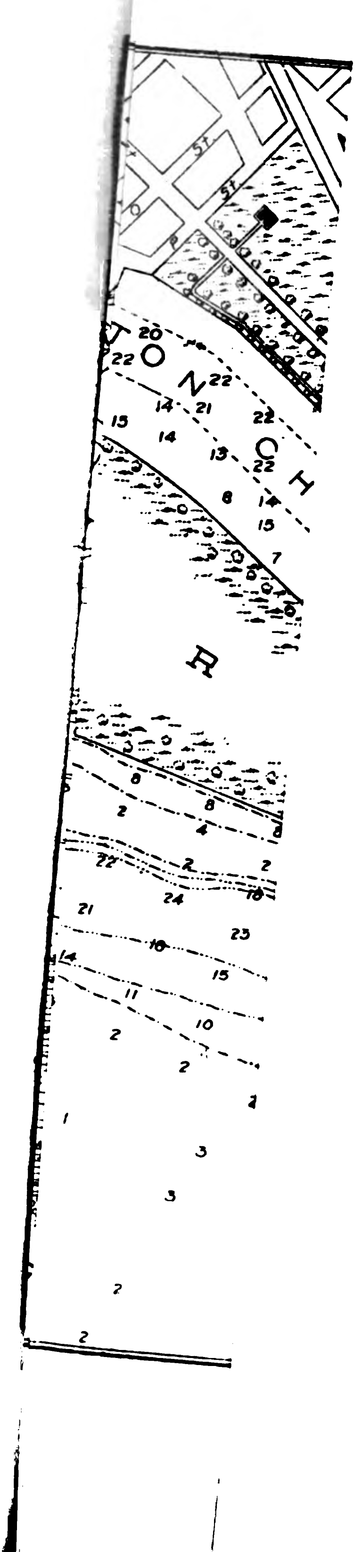
Receipts and shipments.

Calendar year—	Coal.	Ice.	Lumber.	Sand.	Wood.	Miscellaneous.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1887	264.947	120,237	37,044	50,000	52,419	94,325	618,972
1888	240,836	108,421	45,101	50,000	83,040	104,177	581,575
1889	92.511	115,506	41,407	75,000	35,351	128,905	488.680
1890	72,089	135,552	69,604	75,000	48,457	118,994	519,696
1891	114,913	123,107	50,106	60,000	48,457	154,636	551,219
1892	280,342	148,692	68,178	20,000	48,457	261,285	766,954
1893	333.837	143,837	33,167	18.000	48.457	76,135	653,433
1894	306,743	138,094	36.935	41,850	58,203	62,763	644,588
1895	291.268	135,158	51,327	39,284	49,930	127,483	693,450
1896	334.293	131,542	44,696	32,400	50,842	129,884	723,657
1897	260,328	106,406	38,694	25,500	29,250	63,320	523,498
1898	259,517	132,510	40,628	23,400	34,500	68,755	559,310

Number of vessels of various classes arriving and departing.

Calendar year—	Steamers drawing from 5 to 15 feet, 100 to 690 tons.	Vessels drawing from 10 to 21 feet, 300 to 2,100 tons.	Vessels drawing from 4 to 10 feet, 80 to 300 tons.	Barges drawing from 5 to 12 feet, 100 to 600 tons.
1887	970	573	2,149	993
1888	710	525	1,588	2,821
1889	675	455	1,563	929
1890	696	491	1,572	286
1891	980	445	1,854	302
1892	1,065	466	2,046	527
1893	906	431	2,301	450
1894	1,118	455	2,388	323
1895	1,060	442	2,055	290
1896	955	527	2,367	325
1897	939	470	2,165	330
1898	1,213	391	1,975	366

Ferry and local passenger steamers are not included in the above.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K 2.

IMPROVEMENT OF POTOMAC RIVER BELOW WASHINGTON, DISTRICT OF COLUMBIA.

GENERAL DESCRIPTION.

The Potomac River is 113 miles in length from its mouth to Georgetown, the head of navigation for sailing vessels. The width of the river varies from 1,000 feet at Georgetown to 7 miles at the mouth. Obstructions to 24-foot navigation below Washington occur at the following localities: (1) Kettle Bottom Shoals, (2) Maryland Point Shoal, (3) Smiths Point Shoals, and (4) Mattawoman Shoal.

SURVEY.

In accordance with the provisions of the river and harbor act of September 19, 1890, a survey of the shoals which were obstructions to 24-foot navigation was made in 1891. A report of this survey was submitted November 6, 1891. It is printed in Ex. Doc. No. 33, House of Representatives, Fifty-second Congress, first session. The following is a brief description of each shoal, with the estimated cost of dredging a channel 200 feet wide and 24 feet deep through the same:

1. *Kettle Bottom Shoals.*—The Kettle Bottom Shoals, which are the first obstruction to 24-foot navigation met in ascending the river, commence 37 miles from the mouth and extend from Cob Point to Lower Cedar Point, a distance of 12 miles. They consist of small shoals, old oyster beds, underlaid with mud, over which are depths of from 10 to 16 feet, scattered over the river in an irregular fashion, making navigation difficult for vessels drawing over 16 feet. There is, however, an old channel near the north bank of the river through which 24 feet can be carried except for a short distance near Swan Point, where there is a small shoal with a ruling depth of 23 feet. The only improvement needed, therefore, is the dredging of a channel through this small shoal at an estimated cost of $1,320.

2. *Maryland Point Shoal.*—The next obstruction is Maryland Point Shoal, near Maryland Point, and 67 miles from the mouth. It is 7,000 feet in length, has a ruling depth of 22 feet, and is composed of soft mud. The estimated cost of a channel at this shoal is $30,195.

3. *Smiths Point Shoals.*—Near Smiths Point are two shoals. The lower, commencing about one-half mile above Maryland Point Shoal, is about 4,500 feet long, has a ruling depth of about 23 feet, and is composed of soft mud. About one-half mile above Smiths Point the upper shoal commences. It is 4,500 feet long, has a ruling depth of 21 feet, and is composed of soft mud. The estimated cost of the dredging required at Lower and Upper Smiths Point Shoals is $33,000.

4. *Mattawoman Shoal.*—After passing Upper Smiths Point Shoal no obstruction to 24-foot navigation is found until Mattawoman Shoal is reached, 82 miles above the mouth of the river. This shoal is 15,300 feet long and has a ruling depth of 19.5 feet. The lower part is composed of sand and gravel, underlaid with mud, and the upper part of mud. The estimated cost of the dredging required at this shoal is $93,885.

The following is a summary of the estimated cost of the improvement for channels 24 feet deep and 200 feet wide:

1. Kettle Bottom Shoals	$1,320
2. Maryland Point Shoal	30,195
3. Smiths Point Shoals	33,000
4. Mattawoman Shoal	93,885
Total	158,400

APPROVED PROJECT.

In the river and harbor act approved March 3, 1899, Congress made the following provision for improving the Potomac River at and below Washington:

> Improving Potomac River at and below the city of Washington, District of Columbia, one hundred thousand dollars: *Provided*, That the Secretary of War May enter into a contract or contracts for the materials and work necessary for the completion of the improvements below the city of Washington, in accordance with the project submitted November sixth, eighteen hundred and ninety-one, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred and fifty thousand dollars, exclusive of the amount herein and heretofore appropriated.

On June 3, 1899, the Secretary of War allotted the sum of $26,000 from the above-mentioned appropriation to be applied to the improvement of Potomac River below Washington, so that the amount available for the work under the above provision of law becomes $176,000. The approved project for the improvement provides therefore for dredging channels 200 feet wide and 24 feet deep through all shoals of less than 24 feet ruling depth below the city of Washington, the work to be done under a continuing contract.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1899.

Specifications for the dredging have been in course of preparation, but inasmuch as nearly eight years have elapsed since the surveys were made, it was deemed advisable to make examinations at the several bars before issuing specifications, in order to ascertain whether any material changes had taken place in the interim. These examinations were commenced June 28, 1899, and at the close of the fiscal year were still in progress. Proposals for the work will be invited and specifications issued early in the next fiscal year.

Appropriation.

March 3, 1899, allotment from appropriation for improving Potomac River at and below Washington	$26,000

The sum of $150,000 mentioned in the act of March 3, 1899, can be profitably applied as soon as appropriated to the work to be done under the continuing contract.

The project submitted November 6, 1891, referred to in the act of March 3, 1899, in which was the provision for a continuing contract for the improvement below Washington, is the project contained in a report by Colonel Hains, and which was published as Ex. Doc. No. 33, House of Representatives, Fifty-second Congress, first session. The following is quoted from that report:

> *At the city of Washington.*—From the upper end of Mattawoman Shoal to the city of Washington there is ample water for vessels drawing 24 feet. The project for the improvement of the Potomac River at Washington, D. C., provides for channels 20 feet deep at low tide, and this depth was secured by dredging both in the Washington and Virginia channels. The estimate for 24-foot navigation, given below, provides, therefore, only for deepening the channels at Washington from 20 to 24 feet at low tide. The cost of this work is estimated as follows:
>
> For a channel 200 feet wide and 24 feet deep in the Virginia Channel and in the Washington Channel up to the wharves and 300 feet wide and 24 feet deep in front of the wharves:

Virginia Channel, dredging 271,000 cubic yards, at 16 cents	$43,360
Washington Channel, dredging 533,000 cubic yards, at 16 cents	85,280
Contingencies, 10 per cent	12,864
Total	141,504

The entire cost of the improvement of the Potomac River for 24-foot navigation, from the mouth up to the city of Washington, would be as follows:

1. Kettle Bottom Shoals	$1,320
2. Maryland Point Shoal	30,195
3. Smiths Point Shoals	33,000
4. Mattawoman Shoals	93,885
5. At the city of Washington	141,504
Total	299,904

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899 (allotment)	$26,000.00
July 1, 1899, balance unexpended	26,000.00
July 1, 1899, outstanding liabilities	160.00
July 1, 1899, balance available	25,840.00
Amount (estimated) required for completion of existing project	150,000.00
Amount that can be profitably expended as soon as appropriated	150,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

K 3.

IMPROVEMENT OF OCCOQUAN CREEK, VIRGINIA.

The present project for improvement, adopted December 5, 1890, and following an appropriation of $10,000, made September 19, 1890, provides for dredging to afford depths of 6 feet and widths of 100 feet, and dike work at bars as follows:

Lower Mud.—A channel 6 feet deep to be dredged, the "upper section" for about 2,500 feet below Taylors Point to be 100 feet wide, the material to be deposited on the west side of the channel, and the remainder of the channel, or "lower section," to be 150 feet wide.

Upper Mud.—A channel to be dredged, the material to be deposited on the east side of the channel and the embankment so formed connected with the left bank by a dike.

Sand Bar.—A channel to be dredged, and sheet-pile dikes constructed to maintain the dredged channel.

Occoquan Bar.—A channel to be dredged, and a dike to be constructed to maintain the depth.

The estimated cost of this (the present approved project) is $45,000.

The last appropriation for this work consisted of $2,500, made by act of March 3, 1899.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1899.

No dredging or dike work was done during the year. The several channels between the mouth of the creek and the town of Occoquan were swept and examined and a number of snags, logs, etc., which obstructed navigation were removed. This work was done by hired labor and the use of the United States snagging plant.

An appropriation of $2,500 for continuing the improvement was made in the act of March 3, 1899. The funds will be applied to the widening and deepening the channels through the several bars by dredging. The work was advertised for contract June 28, 1899.

Occoquan Creek is in the collection district of Alexandria, which is also the nearest port of entry. The nearest light-house is at Fort Washington, Md.

Money statement.

July 1, 1898, balance unexpended	$69.02
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	2,569.02
June 30, 1899, amount expended during fiscal year	126.97
July 1, 1899, balance unexpended	2,442.05
July 1, 1899, outstanding liabilities	20.00
July 1, 1899, balance available	2,422.05
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	4,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made for the new project:

September 19, 1890	$10,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,500
March 3, 1899	2,500
Total	25,000

COMMERCIAL STATISTICS.

[Furnished by Messrs. L. Ledman and Tyson Janney, Occoquan, Va.]

Receipts and shipments by water.

Articles.	1891.	1892.	1894.	1895.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal	100	100	100	100	100	150	100
Fertilizers	....	....	....	200	....	....	....
Flour and grain	60	550	900	1,400	1,200	900	500
Lumber	600	800	320	200	300	210	500
Piles	....	....	1,000	100	2,150	....	600
Railroad ties	3,600	3,000	3,600	2,500	7,000	4,000	3,000
Sand	....	48,000	....	5,000	23,400	5,000	11,200
Wood	3,500	3,600	2,400	750	7,120	2,400	2,240
Miscellaneous	345	655	580	225	400	3,175	1,725
Rock	....	....	....	....	....	....	10,000
Total	8,205	56,705	8,900	10,475	41,670	15,835	29,865

Arrival and departure of vessels.

Class.	Number.	Tonnage.
Steamers drawing less than 10 feet	320	12,800
Sail vessels drawing less than 10 feet	150	4,500
Barges, flatboats, etc	800	100,000

No new lines of transportation were established in 1898. It is reported that the work done has lessened the cost of shipping, since vessels can now load more heavily at the wharves, whereas formerly part of the cargo had to be taken out to them in lighter-draft boats.

K 4.

IMPROVEMENT OF AQUIA CREEK, VIRGINIA.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1899.

No field work was done during the year, the improvement having been completed during the fiscal year ended June 30, 1898. The maps of the work were finished and the office records closed. The unexpended balance of the appropriation was deposited in the Treasury.

Money statement.

July 1, 1898, balance unexpended	$712.61
June 30, 1899, amount expended during fiscal year	249.25
July 1, 1899, balance unexpended	463.36

Appropriations.

The following appropriations have been made for the new work:

September 19, 1890	$10,000
July 13, 1892	5,000
August 18, 1894	3,000
June 3, 1896	3,000
Total	21,000

K 5.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1899.

No work of improvement was done during the fiscal year ending June 30, 1899. An examination of the dredged channel was made in May, and shoals of slight extent were found at the extreme outer and inner ends of the channel, which need to be removed.

An appropriation of $10,000 for continuing the improvement was made in the act of March 3, 1899. The funds will be applied to extending the east jetty and raising it to a height of 4 feet above low tide. Some dredging through shoals will also be done. This latter work was advertised for contract June 28, 1899.

BENEFIT TO COMMERCE AND NAVIGATION.

An idea of the value of the improvement can be obtained by inspecting the table of commercial statistics given below.

The sum of $12,000 can be profitably expended during the fiscal year ending June 30, 1901, in dredging and jetty construction.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1898, balance unexpended	$61.85
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	10,061.85
June 30, 1899, amount expended during fiscal year	43.43
July 1, 1899, balance unexpended	10,018.42
Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	12,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

May 3, 1873	$10,000	September 19, 1890	$5,000
June 23, 1874	6,000	July 13, 1892	10,000
March 3, 1875	5,000	August 18, 1894	5,000
March 5, 1879	2,500	June 3, 1896	2,500
June 14, 1880	5,000	March 3, 1899	10,000
March 3, 1881	2,000		
August 2, 1882	2,000	Total	70,000
August 11, 1888	5,000		

COMMERCIAL STATISTICS.

[Furnished by Mr. F. E. Tubman, Mount Holly, Va.]

Receipts and shipments by water.

Articles.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal	10	8	10	8	10	5	10
Farm produce	100	150	100	150	125	150	8,000
Grain	400	500	4,500	4,000	3,500	3,000	3,000
Lumber	500	400	6,000	5,000	400	100	300
Oysters	5,000	4,000	3,500	3,000	500	500	400
Railroad ties	5,000	4,500	3,000	3,000	2,000	2,500	2,000
General merchandise	10,000	....	....	90	90	115	100
Wood	....	8,000	1,000	....	800	1,000	800
Ice	....	....	....	....	....	....	80

K 6.

IMPROVEMENT OF LOWER MACHODOC CREEK, VIRGINIA.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1899.

No work of improvement was done during the fiscal year ending June 30, 1899. An examination of the channel was made in May, 1899.

An appropriation of $1,500 for continuing the improvement was made in the act of March 3, 1899. The funds will be applied to dredging in the channel and deepening the uncompleted part to 9 feet. The work was advertised for contract June 28, 1899.

The dredged channel is now 150 feet wide, the least depth outside of the above-named widths (85 to 110 feet) being 6 feet.

The sum of $2,100 can be profitably expended during the fiscal year ending June 30, 1901, in continuance of dredging.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is at Blackistone Island.

Money statement.

July 1, 1898, balance unexpended	$93.30
Amount appropriated by river and harbor act approved March 3, 1899	1,500.00
	1,593.30
June 30, 1899, amount expended during fiscal year	66.43
July 1, 1899, balance unexpended	1,526.87
Amount (estimated) required for completion of existing project	2,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	2,100.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

The following appropriations have been made:

July 13, 1892	$3,000
August 18, 1894	3,000
June 3, 1896	1,500
March 3, 1899	1,500
Total	9,000

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics pertaining to this work, but without success.

K 7.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1899.

Under date of July 7, 1898, proposals were invited by public advertisement for dredging and rock excavation at and near Fredericksburg Bar, Rappahannock River, the work to be done under the same contract with the dredging proposed at Urbana Creek, Va. Proposals were opened August 6, 1898, and an abstract of proposals received is appended to this report. The lowest bidders were M. A. Dugan and A. M. Clegg, of Washington, D. C. A contract with them was entered into August 26, 1898; the contract was approved September 17, 1898. Dredging operations were commenced in the channel just below the steamboat wharf at Fredericksburg Bar on September 22, 1898. Operations were delayed by the sinking of one of the contractors' scows in the channel and by a severe freshet which occurred October 19 to 24, reaching a height of 12 feet above low tide. The rock excavation was commenced October 27. During November, 1898, some progress was made with the dredging, but the rock excavation proceeded slowly. The rock appeared to be an indurated marl which, after blasting, softened and became sticky on exposure to water, making it very difficult to dredge and deposit. The limit of dredging operations under the contract (10,000 cubic yards) was reached December 3, but the work of depositing the dredged material behind the dikes continued until January 14, 1899. Another freshet occurred December 5 to 8, which washed out a large amount of material from behind the dike where it was being deposited and greatly delayed operations. On January 7, 1899, a third freshet occurred, which also washed out considerable dredged material from behind the dike, which for want of funds had not been closed at the lower end.

Nearly the whole of the month of February, 1899, was lost by reason of freshets and ice. On February 9 the river froze over, and on the 20th of that month an ice gorge which had formed gave way, carrying with it some of the contractors' plant and damaging the dikes to some extent as the ice passed over them. As soon as the river reached its normal condition work was resumed and the rock excavation completed March 31, 1899. The amount of rock removed was 1,339.9 cubic yards. The work accomplished has greatly facilitated the passage of steamers around the turn at the lower end of Fredericksburg Reach.

An appropriation of $15,000 was made by the act of March 3, 1899, for continuing the improvement, and a project for work under this appropriation was submitted to the Chief of Engineers March 23 and approved March 27, 1899. It was proposed to apply the funds to dredging at Fredericksburg and Pollock bars and to the construction and repair of dikes at Fredericksburg Bar. The construction of dike at Fredericksburg Bar by hired labor and the use of the United States plant (combined snag and pile driver boat) was commenced June 24, 1899, and at the close of the fiscal year was still in progress. As the boat was proceeding up the river it removed from the channel six snags which obstructed navigation.

There has been considerable decay of the dikes, which were built to heights of about 6 feet above low tide, particularly in the one immediately below the steamboat wharf at Fredericksburg and the one between the lower end of the Fredericksburg wharves and Hazel Run. It is estimated that the cost of and maintaining these dikes during the fiscal year ending June 30, 1901, will be $2,500. The necessity for an annual appropriation of $7,500 to remove deposits of sand formed after freshets in the river at and immediately below Fredericksburg has been noted in the Annual Reports for a number of years past.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1898, balance unexpended		$9,889.62
Amount appropriated by river and harbor act approved March 3, 1899		15,000.00
		24,889.62
June 30, 1899, amount expended during fiscal year		8,742.12
July 1, 1899, balance unexpended		16,147.50
July 1, 1899, outstanding liabilities		1,258.00
July 1, 1899, balance available		14,889.50
Amount (estimated) required for completion of existing project		114,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$15,000.00	
For maintenance of improvement	10,000.00	
		25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

The following appropriations have been made:

March 3, 1871	$15,000	July 5, 1884	$20,000
June 10, 1872	15,000	August 5, 1886	20,000
March 3, 1873	15,000	August 11, 1888 ($15,000, of which $3,000 was for Urbana)	12,000
June 23, 1874	7,000	September 19, 1890	15,000
March 3, 1875	5,000	July 13, 1892	20,000
August 14, 1876	10,000	August 18, 1894	10,000
August 18, 1878	13,500	June 3, 1896	8,000
March 3, 1879	10,000	March 3, 1899	15,000
June 14, 1880	25,000		
March 3, 1881	15,000		
August 2, 1882	17,000	Total	267,500

Abstract of proposals for dredging and rock excavation in Rappahannock River, Virginia, and dredging in Urbana Creek, Virginia, opened by Lieut. Col. Chas. J. Allen, Corps of Engineers, August 6, 1898.

No.	Name and address of bidder.	Rappahannock River, Virginia.				Amount	Urbana Creek, Virginia.		Total.
		Dredging.		Rock excavation.			Dredging.		
		Per cubic yard.	10,000 cubic yards.	Per cubic yard.	1,660 cubic yards.		Per cubic yard.	10,000 cubic yards.	
		Cents.					*Cents.*		
1	A. M. Clegg and M. A. Dugan, Washington, D. C.	29.75	$2,975	$3.00	$4,980	$7,955	18	$1,800	$9,755
2	John Miller, Washington, D. C	27	2,700	4.90	8,134	10,834	19	1,900	12,724
3	Chas. W. Johston, Lewes, Del	29	2,900	6.45	10,707	13,607	......	......	......

No.	Name and address of bidder.	Commence.	Complete.	Monthly work.	
				Dredging.	Rrock excavation.
				Yards.	*Yards.*
1	A. M. Clegg and M. A. Dugan, Washington, D. C.	Sept. 15, 1898	May 1, 1899	10,000	200
2	John Miller, Washington, D. C	do	Dec. 15, 1898	10,000	800
3	Chas. W. Johnston, Lewes, Del	do	Apr. 15, 1899	8,000	350

CONTRACT IN FORCE.

A. M. Clegg and M. A. Dugan, dredging and rock excavation; dated August 26, 1898; approved September 17, 1898; date of commencement, September 15, 1898; completed, March 31, 1899.

COMMERCIAL STATISTICS.

Tonnage for—	Tons.	Tonnage for—	Tons.
1888	83,600	1895	[1]151,466
1890	83,830	1896	[1]161,196
1892	[1]126,333	1897	[1]158,108
1893	[1]141,750	1898	[1]166,586
1894	[1]144,070		

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[1] Furnished by Mr. William D. Scott, Fredericksburg, Va.

Arrivals and departures of vessels, 1898.

Steam vessels:	
Drawing 10 feet or more	280
Drawing less than 10 feet	92
Sailing vessels:	
Drawing 10 feet or more	485
Drawing less than 10 feet	140
Barges, flatboats, etc	223

The principal articles of commerce are grain, oysters, fertilizers, cattle, farm produce, and general merchandise.

No new lines of transportation were established in 1898. It is reported that the work done on this improvement has greatly reduced freight rates, both by rail and water.

K 8.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1899.

Under date of July 7, 1898, proposals were invited by public advertisement for dredging at Urbana Creek, Virginia, the work to be done under the same contract as that for the dredging and rock excavation at and near Fredericksburg Bar, Rappahannock River, Virginia. Proposals were opened August 6, 1898, an abstract of which is appended to the report on Rappahannock River. The contract was awarded to M. A. Dugan and A. M. Clegg, of Washington, D. C., and was entered into August 26, 1898. The entire contract work to be completed on or before May 1, 1899. The dredging and rock excavation at and near Fredericksburg were done first, and the contractors' plant then towed to Urbana, where it arrived April 4, 1899. Extended repairs were needed to the plant, however, and dredging operations were not commenced until April 13, 1899. The work proceeded slowly, owing to the defective condition of the dredging plant, necessitating frequent repairs. There was some delay from bad weather. The time for completing the contract was extended to June 30, 1899. The channel through the outer bar was widened and deepened so as to facilitate the navigation of vessels and steamers. Dredging operations were continued until June 19, 1899, when the limit of dredging under the contract (10,000 cubic yards) was reached and the work was closed, the outer channel having been completed.

The sum of $10,000 can be profitably expended during the fiscal year ending June 30, 1901.

Urbana is a port of entry in the collection district of Tappahannock. The nearest light-house is that at Bowler Rock.

Money statement.

July 1, 1898, balance unexpended	$2,940.66
Amount appropriated by river and harbor act approved March 3, 1899	3,000.00
	5,940.66
June 30, 1899, amount expended during fiscal year	2,406.43
July 1, 1899, balance unexpended	3,534.23
July 1, 1899, outstanding liabilities	31.00
July 1, 1899, balance available	3,503.23
Amount (estimated) required for completion of existing project	36,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

March 3, 1879	$5,000	September 19, 1890	$3,000
June 14, 1880	2,500	July 13, 1892	3,000
March 3, 1881	4,000	August 18, 1894	3,000
August 2, 1882	4,000	June 3, 1896	3,000
August 11, 1888 (included in an appropriation of $15,000 for Rappahannock River)	3,000	March 3, 1899	3,000
		Total	33,500

CONTRACT IN FORCE.

A. M. Clegg and M. A. Dugan, dredging; dated August 26, 1898; approved September 17, 1898; date of commencement, September 15, 1898; completed June 19, 1899.

COMMERCIAL STATISTICS.[1]

Calendar year—	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
	Tons.	*Tons.*
1891	19,500	22,100
1892	20,095	17,125
1893	55,885	61,290
1894	82,395	88,305
1895	66,530	92,320
1896	187,485	183,925
1897	153,875	181,500

[1] Commercial statistics received for 1898 are not in a form to be used.

The principal articles of commerce are oysters, tobacco, railroad ties, coal, grain, and lumber.

Arrivals and departures of vessels, 1898.

Description.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
Steamers drawing—		
10 feet or more	480	500
Less than 10 feet	960	1,000
Sail vessels drawing—		
10 feet or more	240	200
Less than 10 feet	2,500	2,100
Barges, flatboats, etc		20
Total	4,180	3,820

A daily mail steamer line, running from Carters Creek or Irvington to Urbana, was established during 1896. It is reported that the work done on this improvement has greatly reduced freight rates and permitted the use of larger vessels.

K 9.

IMPROVEMENT OF HARBOR AT MILFORD HAVEN, VIRGINIA.

GENERAL DESCRIPTION.

Milford Haven is a tidal estuary of Chesapeake Bay, situated on its westerly shore, near Cherry Point, at the mouth of Piankatank River, and about 35 miles north of Old Point Comfort. The haven is about 4 miles long and from one-half mile to 1 mile wide. Its general direction is northwest and southeast. The depth in the channel ranges from 6½ to 15 feet, but is generally 7 feet or more. The haven has two entrances, one at the northwest end, at Hills Bay, an arm of Piankatank River, about 2 miles from Cherry Point, and another at the southeast end, on Chesapeake Bay, about 5 miles below Cherry Point, thus separating from the main shore a considerable body of land known as Gwynns Island. Both entrances are obstructed by bars. The southeast entrance is exposed, and as the bar has a ruling depth of but 5 feet is but seldom used. The northwest entrance, from Piankatank River, is the one generally used by vessels and steamers entering the haven. There are three wharves on Milford Haven, and it has a large trade in fish, oysters, and farm products, which are transported chiefly by steamers running to Baltimore, Md. The haven is largely used as a harbor of refuge.

SURVEY.

In compliance with the provisions of the river and harbor act of August 18, 1894, a survey of the bar at the northwest entrance was made September 12 to 22, 1894, and the report of the survey was published in Ex. Doc. No. 299, House of Representatives, Fifty-third Congress, third session. Hills Bay, on the Piankatank River, has a depth of 20 feet, gradually diminishing at its head to 14 feet and then to 12 feet. The channel into Milford Haven turns sharply from a southerly to an easterly course around a shoal which projects from the Gwynns Island shore, and in a distance of 250 feet the depth shoaled in 1894 from 12 feet to 8 feet at the crest of the bar. About 100 feet beyond the crest a depth of 10 feet was found. Thence to Narrows Point, at the entrance, the channel was from 150 to 200 feet wide and from 10 to 15 feet deep, increasing to a maximum of 20 feet off Narrows Point.

The improvement proposed was the dredging of a channel 10 feet deep, with a minimum width of 200 feet, at an estimated cost of $12,500.

APPROVED PROJECT.

In the river and harbor act of March 3, 1899, Congress made an appropriation for the improvement, as follows:

> Improving harbor at Milford Haven, Virginia: Completing improvement in accordance with the project printed in House Document number two hundred and ninety-nine, Fifty-third Congress, third session, twelve thousand five hundred dollars.

The approved project therefore provides for a channel 10 feet deep and 200 or more feet in width dredged through the bar at the entrance to the haven.

OPERATIONS OF THE FISCAL YEAR ENDING JUNE 30, 1899.

An examination of the bar was made June 15 to 19, 1899, in order to ascertain whether any changes had taken place since the survey of 1894. It was found that while the general configuration of the bar remained the same the shoal point had built out more into the channel, while the ruling depth had increased to 9.8 feet. Specifications for the dredging were prepared and proposals for dredging will be invited by public advertisement in July.

The maximum draft that can now be carried over the bar at low tide is 9.8 feet.

APPROPRIATIONS.

The following appropriation has been made:

March 3, 1899	$12,500

No further appropriations are required for this project.

Note.—The steamboats find some difficulty at a bar which has formed inside of Milford Haven since the survey of 1894 was made, but it does not fall within the limits of the project as described in the act of March 3, 1899, and further action looking to a survey and estimate for its removal would undoubtedly have to await action of Congress.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$12,500.00
June 30, 1899, amount expended during fiscal year........................	8.00
July 1, 1899, balance unexpended	12,492.00
July 1, 1899, outstanding liabilities	67.00
July 1, 1899, balance available...	12,425.00

K 10.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1899.

The operations for the fiscal year ended June 30, 1899, consisted in construction of dike at West Point Bar for maintenance of the channel at that point. A contract for building 2,700 linear feet (more or less) of dike was made August 31, 1898, with Justin McCarthy, of Norfolk, Va. The contract was approved September 19. Work under it was to be completed on or before February 1, 1899. The contractor did not commence the construction work until October 12, 1898. The work proceeded slowly, however, and under date of January 24, 1899, and in consequence of his representations as to the cause of his delay, the time for completion of the contract was extended to April 1, 1899. He abandoned the contract, however, on the 23d of January, 1899. In fact, he could not be found, and it was stated that he had left the country. The amount of completed dike work left by him was 667.58 linear feet, for 496 feet of which he had been paid, less 10 per cent retained from payments. The contract with Mr. McCarthy was declared annulled February 6, 1899, and the work was taken up at the contract price by his surety, the American Bonding and Trust Company of Baltimore city. This company completed the work on June 5, 1899.

The total amount expended to include June 30, 1898, was $212,084.62. The amount expended during the fiscal year ended June 30, 1899, was $11,894.08.

Congress, by act approved March 3, 1899, appropriated the sum of $10,000 for continuing the improvement.

Owing to the falling off in the commerce of York River, due to the establishment at Norfolk, Va., of a new shipping terminal, as reported, of the deep-draft ocean-going steamers, the necessity for immediate further work on the improvement appeared to be limited to maintenance of the existing navigable channels to the extent of existing demands. It was accordingly recommended that the appropriation be held in reserve until the opening of the next working season (season of 1900), with a view to such action at that time as the conditions of trade and navigation or of the dredged channel may render advisable, which recommendation was approved by the Chief of Engineers.

Under the circumstances of the case, no estimate is stated herein of funds required for the fiscal year ending June 30, 1901.

Money statement.

July 1, 1898, balance unexpended	$17,665.38
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	27,665.38
June 30, 1899, amount expended during fiscal year	11,894.08
July 1, 1899, balance unexpended	15,771.30
July 1, 1899, outstanding liabilities	884.00
July 1, 1899, balance available	14,887.30
Amount (estimated) required for completion of existing project	69,050.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

Appropriations.

The following appropriations have been made:

June 14, 1880	$10,000	July 13, 1892	$35,000
March 3, 1881	25,000	August 18, 1894	20,000
August 2, 1882	25,000	June 3, 1896	16,000
July 5, 1884	20,000	March 3, 1899	10,000
August 5, 1886	18,750		
August 11, 1888	30,000	Total	239,750
September 19, 1890	30,000		

These appropriations have been applied to work under the original project of 1880, the amended project of 1884, and the further amended project of 1887.

Abstract of proposals for construction of dike in York River, Virginia, opened by Lieut. Col. Charles J. Allen, Corps of Engineers, August 6, 1898.

No.	Name and address of bidder.	Prices per linear foot.	2,700 linear feet.
1	Justin McCarthy, Norfolk, Va	$5.85	$15,795
2	W. B. Bradley, Manchester, Va	5.00	16,200
3	Degnon-McLean Construction Co., New York City	6.50	17,550
4	Benjamin F. Sweeten and Frank B. Sweeten, Camden, N. J. [a]	6.54	17,658
5	Sanford & Brooks Co., Baltimore, Md	6.78	18,171
6	A. M. Clegg, Washington, D. C	8.28	22,356

[a] B. F. Sweeten & Son.

CONTRACT IN FORCE.

Justin McCarthy, constructing dike, dated August 31, 1898, approved September 19, 1898, to be commenced September 15, 1898; to be completed February 1, 1899; extended to April 1, 1899.

COMMERCIAL STATISTICS.

Furnished by Mr. E. T. Lamb, West Point, Va.]

Receipts and shipments.

Class of goods.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	10,960	10,496	10,423	20,000
Cotton	89,227	68,742	67,485	72,235
Farm produce	5,641	3,500	4,000	5,000
Grain	8,220	....	100	150
Iron	43,897	45,501	45,033	41,227
Lumber	7,848	6,081	7,875	8,175
Oysters	12,400	2,780	8,200	2,500
General merchandise	70,930	191,462	188,054	206,706
Railroad ties	14,140	5,000	6,500	1,600
Tobacco	175	8,500	10,000	12,115
Wood	45,900	8,495	9,220	10,000

Vessels arriving and departing.

Class.	1891.	1892.	1893.	1894.
Steamers drawing 10 feet or more	727	724	792	758
Steamers drawing less than 10 feet	104	208	811	810
Vessels drawing 10 feet or more	178	96	90	95
Vessels drawing less than 10 feet	824	190	204	200
Barges, flatboats, etc	191	18	21	10

Repeated efforts were made to obtain commercial statistics for years subsequent to 1894, but they could not be procured.

K II.

IMPROVEMENT OF MATTAPONI RIVER, VIRGINIA.

The Mattaponi and Pamunkey rivers unite at Westpoint, Va., to form the York River. The Mattaponi is navigable for small steamers and vessels from its mouth, at Westpoint, to Aylett, a distance of 38.8 miles, and can be made navigable for small barges for 16 miles above Aylett, to Monday Bridge. The obstructions to 5.5-foot navigation below Aylett are as follows:

Designation.	Distance above West-point, Va.	Length of bar.	Ruling depth at low tide.
	Miles.	*Feet.*	*Feet.*
Line Tree Bar	31.4	2,100	3.8
Latané Bar	32.9	4,500	3
Robinson Bar	33.9	3,500	2.8
Presque Isle Bar	35.1	1,600	3.2
Sale Bar	35.6	1,000	3.1
Walker Bar	36.4	1,900	2.4
Jones Bar	37.8	950	3.1

Above Aylett there are numerous bars, but no work on them was proposed. The river was also obstructed by snags, overhanging trees, and wrecks.

The present project for improvement provides for removal of snags, logs, leaning trees, wrecks, etc., as far upstream as Guineas Bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad, and the improvement of bars below Aylett. The object is to afford a depth of 5½ feet, and a channel width of 40 feet, at low tide, below Aylett, and above that point to confine the improvement to removal of snags, etc.

The estimated cost of the project, as adopted in 1892, is $72,100.

Proposals for dredging were twice invited in 1897. Only one bid was received, which was rejected as too high in price. Further action was then deferred until conditions should be more favorable.

OPERATIONS FOR FISCAL YEAR ENDING JUNE 30, 1899.

No field work was done during the fiscal year ending June 30, 1899. The snagging plant has been fitted up for the season's work on this and other streams in the vicinity, and operations for the removal of snags and other obstructions will be undertaken early in the next fiscal year.

BENEFIT TO COMMERCE AND NAVIGATION.

The work already done upon this river has been of benefit to existing commerce, notwithstanding that much of it has had to be done over again, as snags and other obstructions form in greater or less degree after every freshet. Before any work of improvement was undertaken the trade was limited. There is now one steamer plying between Westpoint and Walkerton (29 miles). Above this point a lighter draft steamer runs to Aylett, 38.8 miles above Westpoint. Below Walkerton numerous vessels load with wood, lumber, etc., for coast ports. The total freight tonnage for 1894 was 39,300 tons. In this connection see commercial statistics herewith.

The sum of $3,000 can be profitably expended during the fiscal year ending June 30, 1901, in continuing work under the approved project.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1898, balance unexpended	$4,916.06
July 1, 1899, balance unexpended	4,916.06
Amount (estimated) required for completion of existing project	42,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

June 4, 1880	$2,500	July 13, 1892	$4,000
March 3, 1881	3,300	August 18, 1894	4,000
July 5, 1884	2,500	June 3, 1896	2,500
August 5, 1886	5,000		
August 11, 1888	3,000	Total	29,800
September 19, 1890	3,000		

COMMERCIAL STATISTICS.

Receipts and shipments.

Class of goods.	Calendar year—				
	1890.	1891.a	1892.a	1893.a	1894.a
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal					1,000
Farm products		2,400		300	500
Grain		1,000		100	350
Lumber	7,700	1,200	5,500	6,200	6,000
Merchandise	10,400	3,120	15,570	17,820	16,000
Ties	6,900	5,640	5,000	5,260	3,200
Wood	7,650	38,700	6,620	6,740	12,250
Total	32,650	52,060	32,690	36,420	39,300

a Furnished by Mr. E. T. Lamb, Westpoint, Va.

Vessels arriving and departing during 1894.

Class.	Number.	Tonnage.
Steam, drawing less than 10 feet	175	9,000
Sail, drawing 10 feet or more	100	30,000
Sail, drawing less than 10 feet	90	15,000
Barges, flatboats, etc	5	400
Total	370	54,400

Repeated efforts were made to obtain commercial statistics for years subsequent to 1895, but they could not be procured.

K 12.

IMPROVEMENT OF PAMUNKEY RIVER, VIRGINIA.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1899.

No field work was done during the fiscal year ending June 30, 1899. The snagging plant has been fitted up for the season's work on this and other streams in the vicinity, and operations for the removal of snags and other obstructions will be undertaken early in the next fiscal year.

The sum of $3,000 can be profitably expended during the fiscal year ending June 30, 1901, in dredging and removal of snags, logs, and wrecks.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1898, balance unexpended	$3,647.99
July 1, 1899, balance unexpended	3,647.99
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	2,500
August 2, 1882	2,500
August 5, 1886	5,000
August 11, 1888	3,000
September 19, 1890	3,000
July 13, 1892	$3,000
August 18, 1894	2,000
June 3, 1896	2,000
Total	25,500

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, Westpoint, Va.]

Receipts and shipments.

Articles.	1893.	1894.
	Tons.	*Tons.*
Coal	....	5,000
Grain	75	750
Ice	5,145	....
General merchandise	100	10,000
Lumber	10,000	1,000
Railroad ties	15,000	15,000
Wood	20,100	10,500
Total	50,420	42,250

Repeated efforts were made to obtain commercial statistics for years subsequent to 1894, but they could not be procured.

K 13.

IMPROVEMENT OF JAMES RIVER, VIRGINIA.

The present project for improvement of this river is in accordance with the act of Congress of July 5, 1884. It has in view the obtaining a depth of 22 feet at mean low tide from the sea to Richmond, the channel widths to be 400 feet from the sea to City Point, 300 feet thence to Drewry Bluff, and 200 feet thence to Richmond. The estimated cost of this project, which was a modification of the original project, is $4,500,000. The work for accomplishing this effect has been excavation through shoals by dredges, removal of rock, and construction of dikes and jetties to regulate the waterway in part. Solid rock excavation has constituted a large item of the work, and more of the same remains to be done. It is necessarily costly.

WORK OF THE FISCAL YEAR ENDED JUNE 30, 1899.

No work for channel improvement was done during the year, some small repairs to existing works excepted. The appropriation of June 3, 1896, had been about exhausted by the close of the fiscal year 1898, the balance available at that date being needed for maintenance of dikes, care of property, and general contingencies, until a new appropriation should be made.

Mr. William M. Jones, who had been the zealous and efficient clerk of the United States engineer office at Richmond for many years, died December 28, 1898, and his place was filled temporarily by Mr. George R. Talcott.

In February, 1899, a freshet and heavy break-up of the ice in James River occurred at and in the vicinity of Richmond, the surface of the water reaching an extreme elevation of 26.9 feet above mean low tide, inundating the lower parts of the city. The moving ice carried away the United States engineer wharf mooring piles, broke the piles that supported the tide-gauge house, and carried the United States tug *Leslie*, steam launch *Nat*, and a scow several miles downstream. An old lighter, fitted up with hoisting machinery, was carried a number of yards inland and a scow beached. The boats carried down the river were all recovered. For the prompt recovery of some of the plant we are indebted to Mr. C. P. E. Burgwyn, assistant engineer, and some of the citizens of Richmond, who have been thanked for the same in letters from this office. Mr. Talcott, who had been acting as clerk, died while endeavoring to recover the plant. He was an active and efficient assistant and his loss was keenly felt. The dikes for improvement of the river sustained slight injuries, which were repaired during the past spring by hired labor.

Reconnaissances and examinations of river were made at certain points during the spring in order to obtain data bearing upon operations to be undertaken under the appropriation of March 3, 1899, for continuing the improvement, and a project for application of that appropriation was submitted by me under date of June 19, 1899.

The amount expended under the present project to July 1, 1898, was $1,752,660.84, of which the sum of $50,130.73 was expended during the fiscal year ended June 30, 1898. Of the results of the work to that date Mr. Whitcomb, then the assistant engineer, wrote as follows:

> The 18 by 100 foot channel is completed to within 775 feet of Richmond City line, and from that point to Hampton Roads there is a channel with not less than 18 feet at mean low tide. Above that point a cut 25 feet wide at bottom has been made through Rocketts Reef and to within 170 feet of the city line. The old channel through the reef is found to have a few points of from 14.5 to 15 feet depth, or from 18 to 18½ feet at full tide. The navigable depth at full tide is about 18 feet.

A saving of about 5½ miles of difficult navigation was effected several years ago by the opening of Dutch Gap Cut-off.

The amount expended during the past fiscal year was $16,691.85.

The channel has not deteriorated since the annual report for 1898 was submitted. The value of the improvement effected, the need of further improvement, and the relation of the same to the commerce of the river may be appreciated from the statistics appended to this report.

The sum of $400,000 can be profitably expended during the fiscal year ending June 30, 1901, in furtherance of the approved project for improvement of this valuable and important natural highway for commerce.

For an account of the improvement and of work pertaining thereto, reference is made to my last annual report and the appended very complete report of Mr. H. D. Whitcomb, assistant engineer, who resigned August 10, 1898, after many years of honorable professional service in connection with the improvement.

The post of assistant engineer in local charge was filled March 20 last by Mr. S. H. Yonge, a civil engineer of experience. His report of operations since that date is herewith.

Money statement.

July 1, 1898, balance unexpended	$19,839.16
Amount appropriated by river and harbor act approved March 3, 1899	150,000.00
	169,839.16
June 30, 1899, amount expended during fiscal year	16,691.85
July 1, 1899, balance unexpended	153,147.31
July 1, 1899, outstanding liabilities	670.00
July 1, 1899, balance available	152,477.31
Amount (estimated) required for completion of existing project	3,317,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	400,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made for this work:

July 11, 1870	$50,000	August 2, 1882	$75,000
March 3, 1871	50,000	July 5, 1884	75,000
June 8, 1872	50,000	August 5, 1886	112,500
March 3, 1873	75,000	August 11, 1888	225,000
June 23, 1874	50,000	September 19, 1890	200,000
March 3, 1875	50,000	July 13, 1892	200,000
August 14, 1876	60,000	August 18, 1894	100,000
June 18, 1878	70,000	June 3, 1896	120,000
March 3, 1879	75,000	March 3, 1899	150,000
June 14, 1880	75,000		
March 3, 1881	60,000	Total	1,922,500

COMMERCIAL STATISTICS.

Receipts and shipments, in tons, by water during the calendar year 1898.

Articles.	Port of Richmond, Va.			Points on James River other than Richmond, Va.			Total tonnage.
	Receipts.	Shipments.	Amount.	Receipts.	Shipments.	Amount.	
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Asphalt blocks, bricks, etc	1,193	60	1,253		12,000	12,000	13,253
Coal	37,944	14	37,958	2,723	100	2,823	40,781
Cotton					15	15	15
Farm produce	28		28	259	4,166	4,425	4,453
Fertilizers	46,385	1,409	47,794	5,580		5,580	53,374
Grain	624		624	407	1,746	2,153	2,777
General merchandise	55,276	17,034	72,810	3,060	215	3,275	75,585
Horses and cattle					29	29	29
Ice	4,780		4,780	175		175	4,955
Iron	2,493	4,044	6,537	147	31	178	6,715
Lime, cement, etc	5,756	25	5,781	1,395		1,395	7,176
Lumber	30,801	79	30,880	13	105,146	105,159	136,039
Molasses	127		127				127
Oil	1,600		1,600				1,600
Oysters and fish	1,461		1,461	11	251	262	1,723
Railroad ties	58	35,008	35,066		10,495	10,495	45,561
Salt	2,235	1	2,236				2,236
Staves		2,799	2,709				2,799
Tobacco		16,205	16,205	2	7	9	16,214
Wood	797		797		56,569	56,569	57,366
Total receipts and shipments	191,558	76,678	268,236	13,772	190,770	204,542	472,778

Arrival and departure of vessels during the calendar year 1898.

Class.	Port of Richmond, Va.	
	Number.	Tonnage.
Steam, drawing 5 to 16 feet	1,049	930,807
Sail, drawing 4 to 17 feet	664	268,939
Barges, etc	366	83,052
Total	2,079	1,282,798

Returns for points on James River below Richmond, Va., were too incomplete for report.

REPORT OF MR. SAMUEL H. YONGE, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
905½ EAST MAIN STREET,
Richmond, Va., July 3, 1899.

COLONEL: I have the honor to submit my report pertaining to improving James River, Virginia, for the part of the fiscal year ending June 30, 1899, beginning March 28, 1899.

In accordance with your instructions I proceeded on the latter date from Washington, D. C., to Richmond, Va., and took local charge of the Richmond office and of the improvement of James River being carried on under your direction.

The operations conducted since my arrival at Richmond consisted principally of making preparations for continuing the improvement under act of Congress approved March 3, 1899, by preparing a project, examining the plant, and making estimates of cost of its repair.

Other duties performed under this office during the period mentioned comprised making estimates of the extent and cost of dredging necessary to give channels of 18 feet and 22 feet at mean low tide through Harrisons Bar and the shoals at Coggins Point, Dancing Point, Goose Hill Flats, and Swans Point; caring for plant; preparing an estimate of cost of making a survey and borings between the ship locks of the James River and Kanawha Canal at Richmond and the lower city limits; making reports on the crossing of the James River at Richmond by the Richmond, Petersburg and Carolina Railroad on the sunken barge *John Hagan* in the James River at Richmond; making an examination of and report on the wharf constructed by Converse & McKimmie near Point of Shoals Light; driving mooring piles at the outer ends of some of the jetties between Richmond and Falling Creek, and mooring piles at the Government wharf opposite Richmond, Va.; also making an instrumental survey of the 1,700 feet reach of river immediately below the lower entrance of Dutch Gap, to determine changes in position and section of channel since 1892, and sounding on the lines of training dikes and in the channel between Richmond and Drewry Bluff.

The most important event of the year was the formation and movement, in February, of an ice gorge extending from the foot of the rapids at Richmond to 12 miles or more below the city.

It appears from all accounts that the river was closed by ice February 14, on account of which, and heavy rains in the upper part of its watershed, it began to rise February 17.

At 2 p. m. February 18 the river at Mayo Bridge reached an elevation of 26.9 feet above mean low tide, when the gorge moved, doing considerable damage to wharves and wharf buildings. The above stage of water exceeded all freshets since 1870, which is as far back as there appears to be a record, except that of November, 1877, which was 2.13 feet higher. It inundated the lower parts of the city from 3 to 4 feet.

By the ice movement the Government wharf, mooring piles, and the piles carrying the tide-gauge house were broken down; the steam tug *Robert Leslie*, one steam scow, and the steam launch *Nat* carried several miles down the river; an old lighter carrying hoisting machinery carried 75 feet inland and stranded, and a scow hulled and beached on the river bank above high tide.

The improvement works escaped with slight damage, consisting of a few small breaches being made through some of the jetties, and the piles at their stream ends, for indicating their positions when submerged, being broken.

The plant carried down the river was recovered and returned to the city March 31. The wharf mooring piles were replaced in March and forty of the jetty piles, where most needed, in May, both under informal contract.

Several freshets occurred during the year. The dates and elevations of their crests, as reported by the Weather Bureau, referred to mean low tide, are as follows:

	Feet.
October 23, 1898	+15.6
January 7, 1899	+17.0
March 7, 1899	+15.6
March 20, 1899	+18.7

On the afternoon of June 13 the steamship *Old Dominion*, while bound down the river, met the steamer *Pocahontas* coming upstream. By bearing too far to the right the former vessel got outside of the channel and struck a submerged rock about opposite the Richmond Cedar Works wharf. To prevent its sinking, the ship was run aground about 2 miles below the city, just above Goodes Rocks.

The stage at the time of the accident was about half tide and the vessel's draft reported at about 10 feet.

After temporary repairs were made to the ship, it was taken to Newport News, Va., and placed in dry dock. The repairs were completed and the ship again put in service in a few days.

The force employed at this point since my arrival has consisted of Mr. George A. Jones, draftsman, and Mr. E. G. Higginbotham, inspector and overseer, the latter since April 19; also the watchmen and laborers required for care of plant and other necessary field duties.

Very respectfully,

SAMUEL H. YONGE, *Assistant Engineer.*

Lieut. Col. CHAS. J. ALLEN,
Corps of Engineers, U. S. A.

K 14.

PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

In order to an understanding of the situation regarding this work, the following is quoted from Appendix K 12 to the Annual Report of the Chief of Engineers for the fiscal year ended June 30, 1898:

> The river and harbor act of August 18, 1894, contained the following item:
>
> Protecting Jamestown Island from the encroachments of James River, ten thousand dollars, or so much thereof as may be necessary.

Abrasion of the shore of the island had been going on for years and had reached a condition that required checking if the old landmark was to be preserved. The injury has been caused by the action of the waves raised by the winds, mainly in the broad stretch above. These waves undermined the banks. The worst winds are from northwest to west; next, those from southeast to south; but north and south winds are also hurtful.

The plan adopted was to build a wall faced with granite, laid without mortar, in front of the threatened part of the island, to grade and turf the bluff behind it, and to add several groins in front of the wall. This work was completed June 5, 1895, under contract dated December 26, 1894. Amount expended to June 30, 1896, inclusive, $9,174.92.

The soil of the island is light and easily moved. The funds did not admit of covering the front requiring protection with the kind of work desirable. Storms, especially those of the winter of 1895 and 1896, greatly damaged the protection work.

The river and harbor act of June 3, 1896, appropriated for this work as follows:

> Protecting Jamestown Island from the encroachments of James River, fifteen thousand dollars, or so much thereof as may be necessary.

Examination of the eroded front was made during the winter of 1896 and 1897, and a project for the application of the appropriation of 1896 was submitted in April following. The project was approved. No work of construction, however, was undertaken during the fiscal year, and for the reason that satisfactory arrangements were not perfected whereby working parties could go upon certain land the protection of the front of which would have constituted the principal part of the work.

Prior to commencing work of protecting the front of the island under the appropriation of 1894, the engineer officer then in charge secured a permit from the proprietors of said land authorizing him to enter upon the property and put upon it the materials for the necessary structure and then to put up the structure itself to protect the property from the washing of the river; and further, to use any wharves, roads, or other conveniences which he might require.

It was claimed, when the matter came up of continuing the work under the appropriation of 1896, that when the protection work was done under the appropriation of 1894 some of the contractors' men committed depredations upon the said property. The owners thereof were unwilling to take the risk of possible further experience of that nature, and in consequence desired to establish conditions as to workmen and teams occupying or traversing the land that this office could not agree to and which the assistant engineer in local charge considered would practically rule the men off the ground. After more or less correspondence and several interviews by the assistant and myself a map was prepared in October last, in this office, together with a form of permit that it was thought would be unobjectionable, and the two sent to the representative of the party owning the said land. They were not accepted, however, and the matter has remained unsettled. Further effort will be made early in the coming fiscal year to arrive at an understanding which will enable the work to be undertaken.

It should be said that the owner of the other piece of property that would probably be protected to a small extent gave the necessary permission to enter upon the land.

The length of bank requiring immediate protection is about 2,600 feet. The money available for protection work is as follows:

Balance from old appropriation	$725.55
Appropriation of 1896	15,000.00
Total	15,725.55

This sum affords about $6 per running foot of bank, and is inadequate for as thorough and solid a protection as desired.

The plan for the work, based upon the funds available and with a view to covering, if possible, the entire portion subject to erosion, contemplates regrading the bank and levee where necessary, bringing it to a regular and even slope, and covering it with a slope wall of good-sized stone laid in hydraulic mortar, the toe of the stone-slope wall to be protected by riprap and concrete block, so far as the funds will admit of. It is possible that a further expenditure may be needed for reenforcement of the toe of the slope, but no estimate for it is rendered herein.

As to the probable cost of this work, there does not appear to be among the records of this office any original official plan or estimates of cost.

The two appropriations made for the work (those of 1894 and 1896), and which are quoted above, simply provide for protection of the island from the encroachments of the river. As about 2,500 to 2,600 linear feet of the island shore were exposed to erosion, the first appropriation was applied, as it appears, in such manner as to protect, so far as funds would permit, the whole extent of front eroded and immediately threatened, that seeming to be required by the wording of the act. There was no reason, so far as known, for the Department to expect that another appropriation for the protection of the island would ever be made. Otherwise it is not at all unlikely that the advisability of holding the said appropriation until another and considerably larger one should be made would have been considered. With the two united more satisfactory work, not only as to quantity, but also as to quality, could undoubtedly have been undertaken.

No work of construction was done during the past fiscal year.

On the 10th of June, 1899, the last permit needed to enable the United States Engineer to enter upon ground, the front of which would be included in the protection, was received by this office.

As said in the last annual report, the appropriation of 15,000 (by itself) is regarded as inadequate for the construction of as thorough and solid protection work along the 2,600 feet of bank as it is desired to build.

Examination of the front will be made as soon as practicable, in order to note changes, if any, that may have occurred. It is very desirable that borings be made along the front, from which to obtain more thorough information as to the character of the underlying strata than is now available. It is expected to commence the work for protection under the appropriation of June 3, 1896, early in the coming fiscal year.

Money statement.

July 1, 1898, balance unexpended	$15,725.55
July 1, 1899, balance unexpended	15,725.55

K 15.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wrecks of schooner "Kate Lawson" in Urbana Creek, Virginia, and of schooner "Leading Breeze" in Potomac River.—On July 16, 1897, this office was informed, by indorsement on a letter addressed to the Chief of Engineers, that the schooner *Kate Lawson* had sunk in Urbana Creek.

An examination made during that month, in consequence of the information received, showed that the wreck lay on the left of the channel, about 450 feet below the steamboat wharf; that the vessel was a wooden schooner, 64.5 feet long, 19.9 feet beam, and 5.8 feet depth of hold, and had a registered net tonnage of 46.36 tons. The vessel was 27 years old and was nearly worn out. She had no cargo and little, if any, ballast. She sank about June 1, 1897. The wreck lay in a depth of from 5 to 6 feet of water on a bottom of soft mud.

On August 5, 1897, a report upon the results of the examination was made to the Chief of Engineers and the removal of the wreck recommended, the estimated cost of removal being $250. This recommendation was approved, and on August 7, 1897, an allotment of $250 for removing the wreck was made from the indefinite appropriation of June 14, 1880, for removing sunken vessels or craft obstructing or endangering navigation. Under date of September 2, 1897, the usual notice by public advertisement was given to all persons interested in the vessel that if within thirty days they should not have signified their intention and have taken preliminary steps to remove the wreck it would be considered abandoned and derelict and would be removed by the United States in accordance with law. Proposals were also invited for the removal of the wreck, to be opened October 2, 1897.

The bids were regarded as too high and were rejected. It was thought that the wreck could be removed by the United States snag and pile-driver boat, by hired labor, within the estimate and allotment, and this method of removal was authorized.

The snag boat was engaged during the fall of 1897 in borings for the survey for the proposed Memorial Bridge across the Potomac River at Washington, and this work was delayed until the close of the working season. The boat was laid up for the winter at Washington, D.C., with the intention of sending her to the Rappahannock River and Urbana Creek in the spring. The war with Spain made it absolutely necessary, however, to keep the snag boat in the Potomac River during the greater part of the season of 1898 for certain work in connection with the defenses of Washington. In the month of October, 1898, the boat was employed in removing the abandoned wreck of the schooner *Leading Breeze* from the channel of the Potomac River between Washington and Alexandria. An allotment of $200 from the indefinite appropriation for removing sunken vessels, etc., was made for the purpose of effecting the removal of this wreck.

In June, 1899, the boat which had been dispatched to Fredericksburg for work on a dike, stopped at Urbana Creek and removed the wreck of the *Lawson* at a cost of $189.38. All the work of removing these wrecks was by hired labor.

K 16.

SURVEY OF ANACOSTIA RIVER.

[Printed in House Doc. No. 87, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 12, 1898.

SIR: I have the honor to submit the accompanying report of December 1, 1898, with maps,[1] by Lieut. Col. Charles J. Allen, Corps of Engineers, of a survey of Anacostia River, with project for improvement, etc., made to comply with requirements of joint resolution of Congress approved April 11, 1898, as follows:

> That the Secretary of War be, and he is hereby, directed to prepare and submit to Congress forthwith a project for the improvement of the Anacostia River and the reclamation of its flats from the line of the District of Columbia to the mouth of said river, with an estimate of the cost of the same and a report on the area and ownership of the land to be reclaimed, and, if any portion of said land is vested in private persons, an estimate of the cost of acquiring the same.

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[1] Not reprinted. Printed in House Doc. No. 87, Fifty-fifth Congress, third session.

Lieutenant-Colonel Allen states that, taking the present plan for a depth of 20 feet in the Potomac as a basis, the necessary ruling depths for navigation of the Anacostia, considered in his report, are 20 feet at low water from the mouth of the river to the navy-yard, with a width of 400 feet; thence to Bennings Bridge, a depth of 16 feet, with widths of 200 to 300 feet; and that, as the flats above Bennings Bridge are beyond the city limits, their improvement might be deferred and attention be given for the present to the portion of the river in front of the city, where interests of the city and of the United States Government are concerned.

Two projects for improvement from the District line to the mouth, with estimate of cost by sections, are presented.

1. Dredging channel and depositing material to an average elevation of 7 feet above low tide, including construction of sea wall and embankment to a height of 14 feet above low tide; estimated to cost, including contingencies:

Section 1. From mouth to Navy-Yard Bridge	$1,218,525
Section 2. From Navy-Yard Bridge to Bennings Bridge	976,195
Section 3. From Bennings Bridge to the District line	644,600
Total	2,839,320

If the embankment and drainage be omitted, the total of this estimate will be reduced to $2,493,480.

2. Dredging channel and depositing dredged material on the flats and transporting material to raise the flats to a height of 14 feet above low tide, including sea wall; estimated to cost, including contingencies:

Section 1. From mouth to Navy-Yard Bridge	$3,291,750
Section 2. From Navy-Yard Bridge to Bennings Bridge	2,646,930
Section 3. From Bennings Bridge to the District line	1,028,500
Total	6,967,180

Assuming that the high-grade filling, although more desirable, would probably not be undertaken on account of its great cost, and that improvement of the river above Bennings Bridge may be deferred for the present, Lieutenant-Colonel Allen suggests the improvement of sections 1 and 2, including reclamation of the flats within these sections, estimated to cost $2,194,720, as the plan probably serving present needs, and as the least expensive; the flats within those sections to be raised to a height of about 7 feet above low tide, and as specified in estimate No. 1; the channels excavated to afford ruling depths of 20 feet at low tide from the mouth to the navy-yard, and of 16 feet thence to Bennings Bridge, with widths as indicated above.

The estimates for this work have been made upon the assumption that large and continuous appropriations will be made so as to permit rapid and uninterrupted work, and it is estimated that $400,000 can be advantageously expended annually under the minimum plan (estimated cost, $2,194,720).

The estimates presented do not include the cost of alteration of bridges which would be necessitated by the improvement, nor the cost of protection of bridge piers which may be affected by excavation so near them.

A list of lands within the limits of the proposed improvement, with names of owners and assessed value thereof, accompanies this report, and Lieutenant-Colonel Allen states that it has not been practicable to obtain any estimate of the cost of acquiring the lands other than that which may be indicated by their assessed values.

I concur in the views of Lieutenant-Colonel Allen and commend this important work to the favorable consideration of Congress.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. CHAS. J. ALLEN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., December 1, 1898.

GENERAL: I have the honor to submit the following report and project pertaining to the improvement of the Anacostia River and the reclamation of its flats, in accordance with the requirements of a joint resolution of Congress approved April 11, 1898, and which is as follows:

[Public Resolution—No. 20.]

Joint Resolution Making an appropriation for the improvement of the Anacostia River and the reclamation of its flats.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he is hereby, directed to prepare and submit to Congress forthwith a project for the improvement of the Anacostia River and the reclamation of its flats from the line of the District of Columbia to the mouth of said river, with an estimate of the cost of the same, and a report on the area and ownership of the land to be reclaimed, and if any portion of said land is vested in private persons an estimate of the cost of acquiring the same; and the sum of two thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay the cost of surveys and other expenses in the premises.

GENERAL DESCRIPTION.

The Anacostia River was formerly known as the Eastern Branch of the Potomac River, and has this designation on many recent maps.

The main stream has its rise in Prince George County, Md., and, flowing in a general southwesterly direction, enters the District of Columbia, and empties into the Potomac River at the southernmost extremity of the city of Washington, Greenleaf Point being on the right or northerly bank and Giesboro Point on the left or southerly bank at the mouth of the river. The former head of navigation for small craft on the Anacostia was Bladensburg, Md., 8¾ miles, by the channel of the river, above the mouth. The range of tides at Bladensburg is 2.1 feet, the width of the stream at that point being 135 feet and the depth at low tide from 1 to 1½ feet.

Between Bladensburg and the District boundary line, a distance of about 1¾ miles, the course of the river is quite tortuous, and the banks, at first firm, gradually become marshy. The depths in the upper part of this section range from 1 to 2 feet, gradually increasing to about 4 feet at the District line. From the District line (the upper limit of the survey) to Bennings Bridge the distance is about 2 miles. At points between these localities the depths range from 3 to 13½ feet and the widths from 115 to 250 feet. This section of the river is bordered by wide marshes or flats with some swamp area, the extreme width of these flats between high-tide lines, and including the river channel, ranging from a minimum of 190 feet to a maximum of 2,520 feet. The flats are covered for many months of the year with a dense growth of wild rice and coarse grasses; also, in one locality, with trees. They are intersected with numerous small streams and are overflowed at high tide. The range of tide at Bennings Bridge is 3 feet, while the width of the channel here is 180 feet and its maximum depth 7½ feet.

Below Bennings Bridge the river, flowing south, follows the firm ground on the left, then turns abruptly to the right and flows west, and soon resuming its southerly course, flows along the comparatively firm ground of Reservation No. 13, on which the District workhouse and jail are located, and below which the river is crossed by the Baltimore and Potomac Railroad bridge. The depth in the channel between these two bridges ranges from 9 to 19 feet, while the low-tide width, where the channel is well defined, varies from 150 to 270 feet. The channel is bordered on the right, below Bennings Bridge, by flats from 1,000 to 2,700 feet wide, composed of extremely soft mud and covered with a dense growth of wild rice. Their average height is 1.4 feet above low tide. At high tide they are, of course, overflowed. The boundary sewer discharges upon this marsh and the ebb and flow of the tide has distributed the sewage over it, where it ferments and gives forth offensive gases.

On the lower part of this section there are flats on the left of the channel near the railroad bridge, which are generally below low tide, depths of water upon them reaching nearly 2 feet. These flats have also a growth of aquatic grasses which facilitates the lodgment of silt and sediment, and is causing rapid shoaling.

The width of the entire river between the lines of high tide ranges in this section from 1,600 to 3,300 feet. The distance from Bennings Bridge to the Baltimore and Potomac Railroad Bridge, in a straight line, is 6,600 feet, while by the river channel it is 7,800 feet. Between the Baltimore and Potomac Railroad Bridge and the Navy-Yard Bridge the channel depths range from 13 to 24 feet at low tide, while the width of the channel between the 3-foot curves ranges from 155 to 350 feet. This part of the river differs from the sections above it in the almost complete absence of flats above low tide. The channel, with a southwesterly direction, follows quite closely the high banks of the southeast portion of the city, while upon its left are flats from 680 to 1,200 feet in width, upon which the depth of water averages generally about 2 feet at low tide. Here the width of the river between its high-tide lines is generally uniform, and ranges from 1,150 to 2,000 feet.

The distance along the channel from the Baltimore and Potomac Railroad Bridge to the Pennsylvania Avenue Bridge is 2,600 feet, while from the first-named bridge to the Navy-Yard Bridge the distance is 6,800 feet. On the portion of the river between the Navy-Yard Bridge and the mouth the channel closely follows the right bank. The ruling depth of channel between the mouth of the river and the navy-yard is about 20 feet for a width of 200 feet, which was secured by dredging at two or three shoals in 1892. At the navy-yard the depth is 20 feet for a width of 150 feet. These channels, however, are very tortuous throughout and difficult of navigation by vessels of ordinary size, and should be considerably widened and also deepened, more or less. Upon the left of the channel are extensive flats extending to the shore with widths of 1,200 to 4,200 feet. These flats have depths of 2 to 4 feet of water at mean low tide, excepting at a few places where dredged material has been deposited or where there has been slight shoaling along the edge of the channel; the depths upon these flats range, generally, from 3 to 4 feet at low tide. These flats have upon them in summer a thick growth of eel grass, which grows in depths of 4 feet or less, and at low stages of the tide obstructs the flow of the current and tends to cause deposits of silt and sewage. This process having gone on for many years, the flats have become undoubtedly malarial.

The distance from the Navy-Yard Bridge, measured along the channel, to the point where it enters the Washington Channel of the Potomac River is 10,800 feet, or about 2 miles. The total distance from the District boundary line to the mouth of the river, measured along the channel, is 36,300 feet, or about 6.9 miles.

EXISTING BRIDGES.

Four bridges cross the Anacostia River within the limits of the District of Columbia and which may be briefly described as follows:

1. *Navy-Yard Bridge.*—This is a wrought-iron Pratt truss, through, highway bridge, crossing the river at the foot of Eleventh street SE. It has 12 fixed spans of 100 feet each and a draw span of about 30 feet. The clear height of the lowest members of the bridge above low tide is 6.8 feet. The width of the roadway is 20 feet, and the width of each of the two sidewalks 6 feet.

2. *Pennsylvania Avenue Bridge.*—This is a wrought-iron Pratt truss, deck and through, highway bridge, crossing the river at the easterly end of Pennsylvania avenue SE. All the spans are fixed spans, the available funds having been insufficient for the construction of a draw. Two through spans over the lines of the Baltimore and Potomac Railroad are 151 feet in length from center to center of end pins. The river is crossed by ten deck spans, of which eight are 112 feet in length from center to center of end pins, while the two trusses of one of the two remaining spans are 112 and 128 feet in length and of the other 128 and 144 feet in length, the piers in the river being askew to the direction of the bridge. The clear height of the lowest member of the deck spans is about 11 feet above low tide. The width of the roadway of the bridge is 24 feet and that of each of the two sidewalks 4 feet, a total width of 32 feet.

3. *Bridge of the Baltimore and Potomac Railroad.*—The Baltimore and Potomac Railroad crosses the river on a double-track pile-trestle bridge which has a clear opening over the channel of 35½ feet spanned by pony plate-iron girders. These girders have a clear head room of about 9½ feet above low tide. The grade of the track is about 11 feet above the same datum. The opening here was formerly 100 feet and spanned by a Howe truss.

4. *Bennings Bridge.*—This is a steel plate-girder bridge with spans of 25 and 35½ feet each, supported by steel posts resting on masonry piers which have pile foundations. The clear head room over the channel of the river is 11½ feet at low tide. The width of the roadway of the bridge is 24 feet and that of each of the two sidewalks 5 feet, making a total width of 34 feet.

PREVIOUS PLANS FOR IMPROVEMENT.

The subject of the improvement of the Anacostia River has been before Congress for many years, and numerous surveys have been ordered. The first comprehensive plan for the improvement of the river, however, was submitted to Congress in compliance with the provisions of the river and harbor act of September 19, 1890. This plan is submitted in a report, by Colonel Hains, Corps of Engineers, dated October 24, 1891, and printed as House Ex. Doc. No. 30, Fifty-second Congress, first session. The report recommended that, at that time, the river be improved from the mouth to the Navy-Yard Bridge, but stated that the part of the river from that bridge to Bennings Bridge would doubtless need improvement at no distant day. The plan of improvement recommended was the dredging of a channel 1,000 feet wide with a depth of 24 feet for a width of 200 feet, this depth diminishing to 12 feet at distances of 100 feet to the right and left of the 24-foot limit, and thence to 6 feet at the margin of the dredged channel; the material dredged to be deposited on the flats or marshes on either side of the river, as might be most advantageous and economical at the time the appropriations should be available.

It was proposed to raise the flats to a height of 6 feet above low tide, and to dredge a basin 400 feet wide in front of the navy-yard. The amount of material to be dredged from the channel below Navy-Yard Bridge was estimated as 4,100,000 cubic yards, and its cost as $656,000. The amount of material to be dredged from the channel, it was stated, would not be sufficient to raise the entire area of flats to the full height of 6 feet above low tide, but it was proposed to obtain some material from the Potomac River. The above estimate provided merely for dredging, and did not include the cost of sea walls or contingencies.

WORK DONE.

An appropriation of $20,000 was made September 19, 1890, for improvement of the Anacostia River, which was applied to dredging channels 20 feet deep and about 200 feet wide through shoals near the foot of South Capitol street, and off the lower end of Washington Barracks. The excavated material was deposited on the flats on the left of the channel at and below Poplar Point, so as to form an embankment on and along the margin of the area proposed to be reclaimed. About $10,000 also were expended by the Navy Department in dredging a basin in front of the navy-yard. The basin was made 22 feet deep and from 100 to 200 feet wide, and the material dredged from it was deposited upon the flats opposite the navy-yard and within the limits of the area proposed to be reclaimed. The foregoing work was completed in 1892. Since that time additional dredging has been done at this locality by the Navy Department.

ESTABLISHMENT OF HARBOR LINES.

The report of October 24, 1891, above mentioned, stated that "harbor lines should be established at an early day along the banks of the river from its mouth to Bennings Bridge." Referring to this statement, the Commissioners of the District of Columbia, on February 15, 1892, addressed a letter to the Secretary of War, requesting that these harbor lines be fixed at as early a date as possible, for the reason that the Commissioners were "continually required to report on projects for bridges across the Eastern Branch and for other matters that require the harbor lines to be considered." A board of officers of the Corps of Engineers was constituted by Special Orders, No. 10, headquarters, Corps of Engineers, February 20, 1892, to consider and report upon harbor lines in the Anacostia River from its mouth to Bennings Bridge. The board recommended in their report, dated May 16, 1892, the establishment of bulkhead and wharf lines between the mouth of the river and the

Pennsylvania Avenue Bridge. The report is printed on pages 1080–1083 of the Report of the Chief of Engineers for 1892. The harbor lines were approved by the Secretary of War May 21, 1892. The established bulkhead and wharf lines are shown upon sheets 1 and 2 of the maps of the survey, which accompany this report. Between the mouth of the river and the navy-yard the distance between bulkhead lines is 1,200 feet and the distance between wharf heads or lines, 800 feet. Between the Navy-Yard Bridge and Pennsylvania Avenue Bridge the distance between bulkhead lines is 900 feet and the distance between wharf heads or lines, 700 feet. The subject of harbor lines above Pennsylvania Avenue Bridge was left for future consideration. It is referred to on page 5 of my report of November 29, 1897, of survey for plan and estimate of cost of a bridge across the Eastern Branch of the Potomac River in line with Massachusetts avenue extended eastward, printed as House Doc. No. 140, Fifty-fifth Congress, second session.

THE SURVEY OF 1898.

The joint resolution of April 11, 1898, providing for the improvement of the river and directing the preparation of the project and estimate, carried an appropriation of $2,000 for the cost of surveys and other expenses, instead of $10,000 as at first proposed. As it was manifestly impossible with the amount appropriated to make complete surveys of the river and prepare the maps, project, and estimates required, it was necessary to utilize, as far as possible, previous surveys and existing maps of the river. The notes and maps of the following comparatively recent surveys made by this office were available: Survey between the mouth of the river and the Navy-Yard Bridge (1890); surveys for harbor lines (1892); survey for a bridge near the foot of South Capitol street (1895); and a survey for a bridge on the line of Massachusetts avenue extended (1897). The greater part of this information referred to the section of the river between the mouth and the Navy-Yard Bridge, but there were also considerable data available relative to the section between the Navy-Yard Bridge and Pennsylvania Avenue Bridge. Accordingly the field operations of the survey were first directed to the upper section of the river between the line of Massachusetts avenue extended and the District boundary line, of which no recent surveys or maps were available.

Available data having been collated during May, a small field party was organized and equipped for hydrographic and shore work and the survey commenced early in June, 1898, on the section of river between the line of Massachusetts avenue extended and Bennings Bridge. Levels were run from an established District bench mark at the Navy-Yard and new bench marks established from which gauges were set for tide observations. Traverse lines were run along both shores and connected with the proposed Massachusetts avenue bridge line on the south and by a line across Bennings Bridge to the north. Sounding stations were set out along the river channel and across the flats on either side and located by actual measurement with a graduated wire and by triangulation and measurement from the stations of the traverse lines along the shores. Measured lines of soundings were taken across the channel at sufficient intervals to permit a proper delineation of its contours. Lines of measured soundings were also taken over the flats in the few cases where a boat could be propelled over them at high stages of the tide. For the most part, however, lines of levels were necessarily run across the flats. Along the shore at and above high-tide mark lines of levels were run to determine the contours of the bank, the level lines being connected with the traverse system. The physical difficulties encountered in making the survey were very great. A mere hydrographic survey of the channel alone would have been a comparatively simple matter, and in the winter or very early spring the survey could have been extended over the flats without serious interruption.

It was necessary for the field party to traverse the flats above low tide on foot to take measurements and levels along the various lines in order to determine elevations. The mud was so soft in many places that a man would sink into it to a depth of 1 or 2 feet from his own weight, while the wild rice had attained such a growth that it was with difficulty that sights could be taken and signals exchanged. In addition the sewage from the great boundary sewer rendered the surroundings almost intolerable for the party.

Under such conditions the field work could not be carried forward rapidly, but it was nevertheless continuously prosecuted, and on July 31, 1898, the survey of the section between the line of Massachusetts avenue and Bennings Bridge had been completed and considerable work had been done on the survey of the section between the bridge and the District boundary line. On this upper section also a traverse line was run completely around the area surveyed. Above Bennings Bridge the flats were somewhat higher, but still covered with a growth of wild rice and aquatic plants. The ground was still very soft and the flats were intersected with numerous "drains" or beds of small streams through which the tide ebbed and flowed. On a part of the area a swamp was found with a heavy growth of timber through which the survey lines had to be cut. The flats here were free of sewage, but with this exception the difficulties of prosecuting the field work were quite as great as below Bennings Bridge.

The survey of the section of river between Bennings Bridge and the District boundary line was completed September 1, and a partial survey made of the section between Massachusetts avenue extended and Poplar Point. A traverse line was run along the left bank between these points, the shore lines located, and a sufficient number of levels taken to develop the topography of the river banks. Sounding stations were set out and lines of soundings taken between the line of Massachusetts avenue and Navy-Yard Bridge, and traverse lines were run along the right bank from the line of Massachusetts avenue to Pennsylvania Avenue Bridge to connect with the harbor-line survey of 1892. This was all the field work which it was practicable to do with the limited funds available, and field operations were brought to a close on September 17, 1898.

MAPS.

Upon the close of field operations, office work was commenced on field notes, and, as soon as practicable, work of plotting the map began. Owing to the small balance available for office work it was found impracticable to finish the map with details of topography, etc., as would have have been desirable, and the tracings are necessarily submitted largely in outline. They, however, show characteristic soundings in the channel and on the flats below low tide, elevations of the flats above low tide, shore lines at high and low tide, bridges, adjacent streets and roads, and all features essential to an understanding of the present condition of the river.

NECESSITY OF IMPROVEMENT.

The necessity for the improvement of Anacostia River has been so fully recognized by Congress in the joint resolution of April 11, 1898, and in previous acts and resolutions calling for surveys or making appropriations for temporary relief to navigation, that no arguments are needed here to emphasize the importance of this work. It is sufficient to review, in a general way, the principal reasons for the project as submitted, and which are as follows:

1. *Access to the navy-yard.*—At the Washington Navy-Yard there has been established one of the finest gun shops in the world for the fabrication of modern guns for the Navy. Large sums have been expended annually in enlarging and increasing the facilities of the establishment. In time of war its insular position makes it of great value. That this important establishment should be accessible to at least several classes of naval vessels is evident. At present this is far from being the case. The channel between the mouth of the Anacostia and the navy-yard is so narrow and crooked that it can not safely be navigated by vessels of any considerable size, while the available depth is insufficient for any except those of very light draft. The channel in this part of the river should be widened and deepened. Congress has before it a project for improving the Potomac River at and below Washington so as to secure a navigable depth of 24 feet at low tide, and the surveys made show that this depth can be secured up to Washington for a comparatively small outlay. This depth, if adopted for the Potomac, should be provided up to the navy-yard, so that, if desired, vessels of about that draft can reach that point.

2. *Increased facilities for commerce and navigation.*—The trade and commerce of Washington are increasing with the growth and extension of the city. Statistics of river traffic during the last ten years, for instance, show an almost steady increase in receipts and shipments of coal, ice, lumber, sand, wood, etc., while the number of vessels arriving and departing each year shows a like increase. The wharf front along the Washington channel furnishes nearly all the existing wharf facilities, and these have been reported as inadequate. If the existing wharves could be rebuilt, additional room could be provided, but the frontage would still be limited and most probably insufficient for the needs of a large and growing city. As practically all the remainder of the Potomac River front below Easbys Point is taken up by Potomac Park (the reclaimed area of Potomac flats), the only place for adequate expansion would be the water front of Anacostia River, where, with a wide and deep channel for navigation, there would be admirable facilities for the construction of substantial and commodious wharves, giving close and convenient access to the southeastern section of the city, with a comparatively short haul for delivery of material and supplies.

3. *Removal of unsanitary conditions.*—The greater part of the area of the Anacostia River along the city front is made up, as already stated, of wide and extensive flats. In the lower sections of the river these flats are submerged at low tide, the depth of water ranging from 1 to 4 feet. In the summer and fall they are covered, as said, with a dense subaqueous growth (known locally as eel grass), which more or less obstructs the flow of the tidal current. In the upper sections of the river and near Bennings Bridge the flats are slightly above low tide, but are overflowed at high tide and covered with a growth of wild rice. Along the Anacostia front of the city there are reported no less than eight sewer outfalls, commencing with the large boundary sewer on the

north and ending with James Creek Canal, near Buzzards Point. These sewers carry a large volume of sewage into the river each day. In the lower part of the river and during ebb tide much of the sewage is carried into the channel, gradually reaching the Potomac. But in the upper part of the river, and particularly on the flood tide, the sewage is carried over the flats and widely disseminated, and as the tide falls it remains lodged in the aquatic grasses, where it ferments in the summer and autumn heat, constituting an active source of disease. The flat at the outlet of the boundary sewer, already described, probably represents the maximum of the existing unsanitary conditions. These same conditions prevail, though in a lesser degree, on the flats below, and particularly on those in front of the navy-yard and the reservation of the Government Hospital for the Insane, as the projection of Poplar Point and the fill made here in accordance with the plan of 1891 tend, as reported, to retard the already slow tidal current.

The result of this unsanitary condition is, as reported, the prevalence of malarial diseases in the portions of the city and District which border the river. Reports of the Surgeon-General of the Navy show that diseases of this character have been prevalent at the navy-yard, while the officer in charge of the Government Hospital for the Insane has frequently called attention in his annual reports to the condition of these flats as the cause of malarial disease in that institution.

The unsanitary conditions which exist on the Anacostia River are substantially the same as those that existed on the Potomac in front of the city of Washington prior to the inception of the Potomac River improvement. The reclamation of the Potomac Flats, although not as yet entirely completed, has very largely corrected the unsanitary conditions along that front, though sewers still discharge into the river. The success of the Potomac work gives every encouragement to undertaking similar work on the Anacostia, for the double purpose of channel and sanitary improvement. Even were a project carried out for the comprehensive and satisfactory disposal of sewage by other methods than discharge of the same into the Anacostia, or into the Potomac, improvement of the river would be desirable, as there would still be deposits of sediment during heavy freshets in the Potomac, not to speak of existing obstructions to navigation in the shape of shoals and tortuous channels.

The Anacostia is essentially a tidal estuary of the Potomac. Its drainage area is about 115 square miles and its average fluvial discharge has been stated as about 60 to 100 cubic feet per second. The river is subject to slight freshets after heavy rains in its basin. The shoaling in the upper reaches of the river is undoubtedly due to sediment brought down by freshets. The material deposited was formerly sand, which a few years ago was, as I am informed, dredged, by hand, for building purposes. The silt was deposited lower down the stream and undoubtedly contributed to the formation of the flats near Bennings Bridge. The greater part of the shoaling in the Anacostia, particularly in the lower reaches, has undoubtedly come from the Potomac River, whose waters, in time of freshets, charged with sediment, back up into the Anacostia, overflowing flats and marshes.

The mean range of tide at the navy-yard, is—according to the United States Coast and Geodetic Survey observations—2.9 feet, practically 3 feet.

In any plan for improvement of the channel of the Anacostia dependence for maintenance of increased depth should rest mainly upon the tidal flow. Obstacles to a free tidal flow should be removed and the tidal prism diminished as little as possible consistent with the accomplishment of other essential features of the improvement.

The harbor lines, established in 1892, bear upon any plan for improvement by dredging. Extension of these lines from Pennsylvania Avenue Bridge to Bennings Bridge, and a system of channel dredging from the mouth to Bennings and deposit of the dredged material upon the flats behind bulkhead lines will best meet the requirements as far up as Bennings, the distance between opposite bulkhead lines between the last-named point and Pennsylvania Avenue Bridge to be approximately the same as between the Avenue Bridge and the Navy-Yard Bridge. This would afford sufficient width of waterway for future needs of navigation, including any river trade which may develop in the eastern part of the city.

As to the least depth of channel to be secured:

The present plan for improvement of the Potomac River at Washington provides for a navigable depth at mean low tide of 20 feet, which is about the ruling low-water depth on the shoals between Washington and the mouth of the Potomac. An increase of the ruling navigable depth to 24 feet, or more, if ordered by Congress, would render necessary the same ruling depth of channel for the Anacostia River up to the navy-yard at least. Taking the present plan, however, for depth of 20 feet in the Potomac as a basis, the necessary ruling depths for navigation of the Anacostia considered in this report are 20 feet at low water from the mouth of the river to the navy-yard, for a width of 400 feet; thence to Bennings Bridge, a depth of 16 feet for widths of 200 to 300 feet. Outside of the bounding lines of the widths named the dredged depths may be gradually reduced so far as navigation is concerned. At the bulkhead lines the dredged depths should not be more than 6 feet. In some portions of the river, however, well removed from the bulkhead lines, dredging to considerable depth will be required in order to obtain material for fill on the flats.

ESTIMATED COST OF IMPROVEMENT.

The cost of improvement of the Anacostia River and reclamation of its flats will depend mainly upon the cost of dredging the channel and deposit of dredged and other material upon the flats.

The work of dredging and conveying the dredged material, through moderate horizontal and vertical distances, for deposit, can be done at reasonably low rates by improved hydraulic dredges. Contract prices for such dredging and deposit of material for the Potomac River improvement have ranged, during the last fourteen years, from 9 to 16½ cents per cubic yard. The price depends largely upon the character of the material to be excavated. The bed of the Anacostia River is generally of soft mud, and the conditions for deposit are favorable. If large and continuous appropriations should be made, so as to admit of carrying on the improvement rapidly and without interruption, the dredging and deposit could be done, it is believed, estimating from present prices of labor, materials, etc., for 10 cents per cubic yard. If, however, appropriations should be small and not continuous, the cost per yard would be much greater. Powerful dredging machines would be necessary, and, in case there should be considerable demand for work of dredging along the Atlantic coast, machines might have to be constructed for the Anacostia improvement, in which case persons proposing to bid for the work would gauge their prices according to the probabilities of size and frequency of appropriations.

The total cost of improvement will also depend upon the grade (elevation) to which the filling on the flats is to be carried. The low-grade fill (to an average elevation of 7 feet above low tide, with a minimum of 6 feet) would be protected against overflow from freshets of the Potomac by an embankment or levee along and near the bulkhead line, raised to a height of 14 feet above low tide, with provision for drainage of the inclosed area. This method of reclamation would not be so complete or so desirable, probably, from a sanitary point of view, as would a high-grade fill carried over the entire area to a height of 14 feet above low tide, or to an elevation of 3 feet above the highest freshet line. The material which it will be practicable to dredge from the channel within the existing harbor lines, however, will hardly suffice for filling to the low grade (7-foot elevation), and it may be necessary, in order to obtain more material, to consider a modification of the harbor lines above Navy-Yard Bridge. In order to provide for the high-grade fill, it will be necessary for the sections between the mouth and Bennings Bridge to obtain additional material from the adjacent country, and at a largely increased cost per cubic yard, and some, also, from the Potomac.

Two estimates are here presented; one for the low-grade fill and the other for the high grade—the sea wall proposed to be of rubble masonry resting on a riprap foundation, similar to the sea wall built for the Potomac River improvement at Washington. Some settling of this wall, founded on soft mud, should be expected, and allowance for it should be made in placing the foundation. For the section above Bennings Bridge a slope wall, or paved slope, has been substituted in the estimate for the sea wall, it being less expensive.

It is assumed that on the right bank or city front of the river between Pennsylvania Avenue Bridge and the mouth the bulkhead wall will be built, and the comparatively small amount of fill required behind it made by the riparian proprietors in connection with construction of new wharves. These items are not included in the project or estimate here submitted.

On the portion of river between Bennings Bridge and the District line the two requirements of providing tidal space and reclamation of the flats can be met either by widening the existing channel or by dredging tidal reservoirs, the dredged material in either case to be deposited on the flats. There seems to be no probability of any trade in this part of the river calling for an improved navigation channel. Tidal reservoirs with curved shore lines would lend themselves readily to any future development of this area as, for instance, a park. The location, lines, and area of such reservoirs, or basins, would necessarily vary with the grade for filling proposed, and would also depend largely upon future use of the reclaimed area. Their form and location would also need more careful and detailed study than is practicable with the limited funds available. They are therefore not shown on the accompanying map. The surface of the flats between Bennings Bridge and the District line is very uniform. The average elevation of the entire area was found by computation to be at the level of high tide or 3 feet above low tide. The quantity of excavation should nearly balance the fill, so that the height of filling being given and a uniform depth of dredging assumed, it was practicable to estimate the area of reservoirs and the amount of dredging required to fill the portion to be reclaimed without laying out definite reservoir lines.

In the estimate an allowance has been made for shrinkage of dredged material of 15 per cent, and for settlement of fill on the soft flats of 10 per cent; total, 25 per cent.

For convenience of reference in the estimate the Anacostia River has been divided into three sections corresponding to the three sheets of the map of the survey, as follows:

Section 1. From the mouth to Navy-Yard Bridge.
Section 2. From Navy-Yard Bridge to Bennings Bridge.
Section 3. From Bennings Bridge to the District line.

ESTIMATE NO. 1.

Dredging channel and depositing material on the flats to an average elevation of 7 feet above low tide. Sea wall and embankment to a height of 14 feet above low tide included.

Section 1.

9,200,000 cubic yards of material dredged and deposited, at 10 cents	$920,000.00
12,250 linear feet of sea wall, at $10	122,500.00
12,250 linear feet of embankment, at $5	61,250.00
Drainage through embankments	4,000.00
	1,107,750.00
Add for contingencies, 10 per cent	110,775.00
Total for section 1	1,218,525.00

Section 2.

5,400,000 cubic yards of material dredged and deposited on flats, at 10 cents	540,000.00
22,830 linear feet of sea wall, at $10	228,300.00
22,830 linear feet of embankment, at $5	114,150.00
Drainage through embankment	5,000.00
	887,450.00
Add for contingencies, 10 per cent	88,745.00
Total for section 2	976,195.00

Section 3.

3,310,000 cubic yards of material dredged and deposited, at 10 cents	331,000.00
25,000 linear feet of slope wall, at $5	125,000.00
25,000 linear feet of embankment, at $5	125,000.00
Drainage through embankments	5,000.00
	586,000.00
Add for contingencies, 10 per cent	58,600.00
Total for section 3	644,600.00

Summary of estimate No. 1.

Section 1	1,218,525.00
Section 2	976,195.00
Section 3	644,600.00
	2,839,320.00

If the items of embankment and drainage be omitted, the total of estimate No. 1 will reduce to $2,493,480.

ESTIMATE NO. 2.

Dredging channel and depositing dredged material on the flats, and transporting material to raise the flats to a height of 14 feet above low tide. Sea wall included.

Section 1.

9,200,000 cubic yards of material dredged and deposited, at 10 cents	$920,000.00
6,500,000 cubic yards of material obtained otherwise than by dredging channel, at 30 cents	1,950,000.00
12,250 linear feet of sea wall, at $10	122,500.00
	2,992,500.00
Add for contingencies, 10 per cent	299,250.00
Total for section 1	3,291,750.00

Section 2.

5,400,000 cubic yards of material dredged and deposited, at 10 cents	540,000.00
5,460,000 cubic yards of material obtained otherwise than by dredging the channel, at 30 cents	1,638,000.00
22,830 linear feet of sea wall, at $10	228,300.00
	2,406,300.00
Add for contingencies, 10 per cent	240,630.00
Total for section 2	2,646,930.00

Section 3.

8,100,000 cubic yards of material dredged and deposited on flats, at 10 cents	810,000.00
25,000 linear feet of slope wall, at $5	125,000.00
	935,000.00
Add for contingencies, 10 per cent	93,500.00
Total for section 3	1,028,500.00

Summary of estimate No. 2.

Section 1	3,291,750.00
Section 2	2,646,930.00
Section 3	1,028,500.00
	6,967,180.00

PROJECT.

The resolution calls for a project and estimate for the improvement of the river and the reclamation of its flats from the District line to the mouth; and two (alternate) projects and estimates are submitted above.

While the high-grade filling would be the more desirable, its cost, $6,967,180, would be so great as to render its undertaking improbable. The estimate for the low-grade filling within the same limits is much less, viz, $2,839,320. The improvement on this latter basis, if confined to sections 1 and 2 extending from the mouth of the river to Bennings Bridge, would cost $2,194,720, and as the flats above Bennings Bridge are beyond the city limits, their improvement might be deferred and attention be given for the present to the portion of the river in front of the city where interests of the latter, as well as of the United States Government, are concerned. Improvement of sections 1 and 2, including reclamation of the flats within these sections, at an estimated cost of $2,194,720, *is therefore presented as probably serving present needs and* *as the least expensive.* The flats within those sections to be raised to a height of about 7 feet above low tide, and as specified in estimate No. 1; and channels excavated to afford ruling depths of 20 feet at low tide from the mouth to the navy-yard, and of 16 feet thence to Bennings Bridge for widths as already indicated in this report. The amount of funds that could be advantageously expended annually, in case of the improvement, under the minimum plan (at an estimated cost of $2,194,720) being ordered by Congress, is estimated as $400,000. The area between the embankment and the shore would probably be covered, more or less, with a growth of vegetation, which unless kept within bounds might become obnoxious; and the deposit of dredged material and earth might also, during the early stages of the improvement, be a source of local inconvenience to some extent.

The following comparison of the estimated cost of the Potomac River improvement at Washington and the foregoing estimates of cost of improvement of the Anacostia and reclamation of its flats may be of interest:

The Potomac River improvement covers about 3½ miles of river, and the area of flats reclaimed is 739 acres, of which 621 acres are land. The original estimate of cost of the project—which was adopted in 1882—for improvement of the channels by dredging and deposit of the dredged material on the flats was $2,716,365. The area of the flats, above Long Bridge, was to be raised to an elevation of about 13 feet above mean low tide, and the area below the bridge to be filled in to the same elevation along the middle longitudinal line, but to slope toward each channel so as to have an elevation of 6 feet above low tide at the margins of the fill. Shrinkage and settling of the deposited material made it necessary, in 1897, to increase the estimate to a total of $2,953,000.

The proposed Anacostia River improvement covers about 7 miles of river, and the area of reclamation would be about 1,389 acres (including reservoirs above Bennings Bridge). The estimated cost of the low-grade filling would be $2,839,320, or of the high-grade $6,967,180. If the work be limited to the part below Bennings Bridge, the area reclaimed will be about 843 acres, at a cost, to low grade, of $2,194,720, or about 6 cents per square foot.

DRAWS AND PIERS OF BRIDGES.

If the improvement be undertaken, provision must be made to enable dredging plant to pass the various bridges in its path, and, as navigation may be expected to follow improved channels, the bridge draws should be made at the same time sufficient for future demands.

In case of making increased depth through any of the spans of existing bridges on the Anacostia River, a question may arise as to the effect upon the piers of excavation so near to them.

The cost of draws, or of that of protection that may be needed for piers, is not included in the estimates herewith.

AREAS AND OWNERSHIP OF LAND.

The lands within the limits of the improvement owned or claimed by private persons lie chiefly between the Baltimore and Potomac Railroad Bridge and the District line. In addition to those lands, there is at Buzzard Point, near the mouth, a small amount of land which would be required in order to reduce the curvature of the channel, as shown on sheet No. 1. The only sources of information as to the lands in question were the maps and records of the District of Columbia, to which reference was made with the permission of the District Commissioners. The accompanying table contains a list, by sections, of the lands within the area proposed to be improved or reclaimed, which are assessed in the names of private persons, with the area of each plot and its assessed value as taken from the records of the assessor's office. These areas, per section, will be required whether the minimum or maximum improvement be made. It has not been practicable to obtain any estimate of the cost of acquiring the lands other than that which may be indicated by their assessed values. This office is without either means or facilities for ascertaining whether the titles to these lands are vested in the parties in whose names they are assessed, and no opinion on this point can be expressed; nor is any opinion expressed as to questions of riparian rights which may arise along any part of the river shore. These matters belong to the courts and legal departments.

In order to facilitate a reference to the location of the various properties, an index map has been prepared from the records of the District of Columbia, showing the lands near the river between the Baltimore and Potomac Railroad Bridge and the District line. The map accompanies this report. Lots within the city limits are indicated by the square and lot numbers, and their areas stated, where practicable, in square feet, while lands above the city limits are indicated by numbers inclosed in circles, and their areas are given in acres and fractions, except that the areas in one subdivision are given in square feet. In the section below Bennings Bridge certain squares stand on the records in the name of the United States. These are included in the table for convenience of reference, but no assessed values are given for them.

Discussion as to ultimate disposition of the reclaimed areas would be premature in this report. The made land will undoubtedly be valuable.

With this report are three tracings from map of the survey, one tracing from index map, and the list of lands already mentioned.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River.

SECTION 1.

No. of square.	No. of lot.	Feet front.	Rate of assessment.	Assessed value.	To whom assessed.
East of south of 667 ...	1	35.83	$1.00	$36.00	J. H. Rathert.
	2	35.83	1.00	36.00	Augustus Burgdorf.
	3	35.83	1.00	36.00	Charles R. Howison.
	4	35.83	1.00	36.00	Ross Thompson.
	5	35.83	1.00	36.00	Do.
	6	35.83	1.00	36.00	Allen C. Clark.
	7	35.83	1.00	36.00	Caroline L. Redmond.
	8	25.00	1.00	25.00	Augustus Burgdorf.
		275.81	....	277.00	

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River—Continued.

SECTION 1—Continued.

No. of square.	No. of lot.	Square feet.	Rate of assessment.	Assessed value.	To whom assessed.
South of 667	1	2,486	$0.05	$124.00	Robert M. Miller.
	2	8,531	.04	341.00	Claudius B. Jewell.
	15	2,753	.04	110.00	J. Harrison Johnson.
	14	3,022	.04	121.00	Peter F. Horning.
	13	3,289	.04	132.00	Henry Landenkohl.
	12	2,500	.04	100.00	Claudius B. Jewell.
	11	875	.04	35.00	J. Harrison Johnson.
		23,456	....	2,963.00	
		Ft. front.			
South of south of 667..	1	96.58	1.50	145.00	Patrick Sullivan.
	2	32.17	.75	24.00	Carrie E. T. Knox.
		128.75	....	169.00	

Summary of Section 1.

Total water frontage..........feet.. 404.56
Total area..........square feet.. 23,456.00
Total assessed value of land.......... $3 409.00

SECTION 2.

[Agricultural lands.]

No. of parcel on index map.	Number of acres.	Rate of assessment.	Assessed value.	To whom assessed.
1.......	47	Not assessed..	....	Adjoining Thos. J. Myers and Augustus Burgdorf.
2.......	.60	.....do	....	Adjoining Geo. B. Miller.
3.......	37	$25.00	$925.00	Adjoining Thos. J. Myers and Augustus Burgdorf.
5.......	9	Not assessed..	....	Do.
	93.60			

[Subdivided lands.]

No. of square.	No. of lot.	Number of square feet.	Rate of assessment.	Assessed value.	To whom assessed.
1132....	1	3,932	$0.02	$79.00	Columbus Alexander.
	2	1,200	.02	24.00	Do.
	6	700	.02	14.00	Michael I. Weller and Geo. R. Repetti.
	7	800	.02	16.00	Thomas L. Tullock.
	13	4,200	.02	84.00	Columbus Alexander.
	14	6,180	.02	124.00	Do.
	15	6,180	.02	124.00	Do.
	16	5,400	.02	108.00	Do.
		28,592	....	573.00	
1133....	1	3,862	.02	77.00	Augustus Burgdorf.
	2	4,492	.02	90.00	Do.
	3	4,492	.02	90.00	Do.
	5	2,500	.02	50.00	Do.
	6	3,000	.02	60.00	Do.
	7	1,000	.02	20.00	Michael I. Weller and Geo. R. Repetti.
	9	2,000	.02	40.00	Do.
	10	4,492	.02	90.00	Augustus Burgdorf.
	11	3,862	.02	77.00	Do.
	12	4,605	.02	92.00	Do.
	13	5,244	.02	105.00	Do.
	14	4,605	.02	92.00	Do.
		44,154	....	883.00	

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River—Continued.

SECTION 2—Continued.

[Subdivided lands.]

No. of square.	No. of lot.	Number of square feet.	Rate of assessment.	Assessed value.	To whom assessed.
1134....	1	1,500	$0.02	$30.00	Michael I. Weller and Geo. R. Repetti.
	8	1,200	.02	24.00	Ellen E. Paine.
	9	5,000	.02	100.00	Michael I. Weller and Geo. R. Repetti.
	10	4,160	.02	83.00	Do.
	11	5,000	.02	100.00	Do.
	12	4,095	.02	82.00	Do.
		20,955	....	429.00	
1137....	1	3,932	.015	59.00	Columbus Alexander.
	2	4,477	.015	67.00	Do.
	3	4,477	.015	67.00	Wm. J. Ackerdathers, trustee.
	4	3,932	.015	59.00	Do.
	5	5,560	.015	83.00	Do.
	6	6,180	.015	93.00	Do.
	7	6,180	.015	93.00	Joseph B. Bailey.
	8	5,560	.015	83.00	Do.
	9	3,932	.015	59.00	Do.
	10	4,477	.015	67.00	Do.
	11	4,477	.015	67.00	Columbus Alexander.
	12	3,932	.015	59.00	Do.
	13	5,560	.015	83.00	Do.
	14	6,180	.015	93.00	Do.
	15	6,180	.015	93.00	Do.
	16	5,560	.015	83.00	Do.
		80,596	....	1,208.00	
1138....	1	3,862	.015	58.00	Augustus Burgdorf.
	2	4,492	.015	67.00	Do.
	3	4,492	.015	67.00	Joseph B. Bailey.
	4	3,862	.015	58.00	Do.
	5	4,605	.015	69.00	Do.
	6	5,244	.015	79.00	Wm. J. Ackerdathers, trustee.
	7	4,605	.015	69.00	Do.
	8	3,862	.015	58.00	Do.
	9	4,499	.015	67.00	Do.
	10	4,499	.015	67.00	Augustus Burgdorf.
	11	3,862	.015	58.00	Do.
	12	4,605	.015	69.00	Do.
	13	5,244	.015	79.00	Do.
	14	4,605	.015	69.00	Do.
		62,338	....	934.00	
1139....	1	4,160	.015	62.00	Ruth Carr Denison.
	2	5,010	.015	75.00	Do.
	3	5,010	.015	75.00	Augustus Burgdorf.
	4	4,160	.015	62.00	Do.
	5	5,567	.015	84.00	Do.
	6	5,567	.015	84.00	Joseph B. Bailey.
	7	4,160	.015	62.00	Do.
	8	5,010	.015	75.00	Do.
	9	5,010	.015	75.00	Ruth Carr Denison.
	10	4,160	.015	62.00	Do.
	11	5,567	.015	84.00	Do.
	12	5,567	.015	84.00	Do.
		58,948		884.00	
1140....	7	300	.015	5.00	David Solomon.
	8	1,020	.015	15.00	Do.
	9	1,122	....	U. S.	
	10	2,080	....	U. S.	
1152....	....	38,850	....	U. S.	
1149....	....	13,500	Ex.	Ex.	Vestry of Christ Church.
1141....	1	3,932	015	59.00	Ezra W. Clark.
	2	4,477	.015	67.00	Do.
	3	4,477	.015	67.00	Joseph B. Bailey.
	4	3,932	.015	59.00	Do.
	5	5,560	.015	83.00	Do.
	6	6,180	.015	93.00	Do.
	7	6,180	.015	93.00	Augustus Burgdorf.
	8	5,580	.015	84.00	Do.
	9	3,932	.015	59.00	Augustus Burgdorf and Allen C. Clark, trustees.
	10	4,477	.015	67.00	Augustus Burgdorf.

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River—Continued.

SECTION 2—Continued.

[Subdivided lands.]

No. of square.	No. of lot.	Number of square feet.	Rate of assessment.	Assessed value.	To whom assessed.
1141....	11	4,477	$0.015	$67.00	Ezra W. Clark.
	12	3,932	.015	59.00	Do.
	13	5,560	.015	83.00	Do.
	14	6,180	.015	93.00	Do.
	15	6,180	.015	93.00	Do.
	16	5,560	.015	83.00	Do.
		80,616	....	1,209.00	
1142....	1	3,862	.015	58.00	William Mayse.
	2	4,492	.015	67.00	Do.
	3	4,492	....	U.S.	
	4	3,862	....	U.S.	
	5	4,605	....	U.S.	
	6	5,244	....	U.S.	
	7	4,606	....	U.S.	
	8	3,862	....		
	9	4,462	....	U.S.	
	10	4,492	.015	67.00	Lewis C. Main.
	11	3,862	.015	58.00	Do.
	12	4,605	.015	69.00	Do.
	13	5,244	.015	79.00	William Mayse.
	14	4,605	.015	69.00	Do.
		....	....	477.00	
		31,132	....	U.S.	
		31,162	....	Private.	
1143....	1	4,160	.01	42.00	Augustus Burgdorf.
	2	5,010	.01	50.00	Do.
	3	5,010	.01	50.00	Elizabeth C. Cablentz.
	4	4,160	.015	62.00	Do.
	5	5,567	.015	84.00	Lewis C. Main.
	6	5,567	.015	84.00	Augustus Burgdorf.
	7	4,160	.015	62.00	Do.
	8	5,010	.015	75.00	Do.
	9	5,010	.015	75.00	Do.
	10	4,160	.015	62.00	Do.
	11	5,567	.01	56.00	Do.
	12	5,567	.01	56.00	Do.
		58,948	....	758.00	
1144....	1	3,862	.01	39.00	Columbus Alexander.
	2	4,892	.01	49.00	Do.
	3	4,892	.01	49.00	Do.
	4	3,862	.01	39.00	Do.
	5	5,214	.01	52.00	Do.
	6	6,180	.01	62.00	Do.
	7	6,180	.01	62.00	Augustus Burgdorf.
	8	5,214	.01	52.00	Do.
	9	3,862	.01	39.00	Do.
	10	4,892	.01	49.00	Do.
	11	4,892	.01	49.00	Do.
	12	3,862	.01	39.00	Do.
	13	5,214	.01	52.00	Do.
	14	6,180	.01	62.60	Michael I. Weller and Geo. R. Repetti.
	15	6,180	.01	62.00	Columbus Alexander.
	16	5,214	.01	52.00	Do.
		80,592	....	808.00	
1145....	1	3,862	.01	39.00	James W. Patterson.
	2	4,492	.01	45.00	Do.
	3	4,492	.01	45.00	Do.
	4	3,862	.01	39.00	Do.
	5	4,606	.01	46.00	Do.
	6	5,243	.01	52.00	Do.
	7	4,606	.01	46.00	Augustus Burgdorf.
	8	3,862	.01	39.00	Do.
	9	4,492	.01	45.00	Do.
	10	4,492	.01	45.00	Do.
	11	3,862	.01	39.00	Do.

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River—Continued.

SECTION 2—Continued.

[Subdivided lands.]

No. of square.	No. of lot.	Number of square feet.	Rate of assessment.	Assessed value.	To whom assessed.
1145....	12	4,606	$0.01	$46.00	Augustus Burgdorf.
	13	5,243	.01	52.00	Do.
	14	4,606	.01	46.00	James W. Patterson.
		62,326	....	624.00	
1146....	1	4,160	.01	42.00	Augustus Burgdorf.
	2	5,010	.01	50.00	Do.
	3	5,010	.01	50.00	Do.
	4	4,160	.01	42.00	Do.
	5	5,567	.01	56.00	Do.
	6	5,567	.01	56.00	James W. Patterson.
	7	4,160	.01	42.00	Do.
	8	5,010	.01	50.00	Do.
	9	5,015	.01	50.00	Do.
	10	4,160	.01	42.00	Do.
	11	5,567	.01	56.00	Do.
	12	5,567	.01	56.00	Augustus Burgdorf.
		58,953	....	592.00	
1150....	....	58,950	....	U. S.	
1151....	....	12,000	....	U. S.	
1153....	....	58,950	....	U. S.	
1154....	....	40,243	....	U. S.	
1155....	....	80,508	....	U. S.	
1156....	....	62,332	....	U. S.	
1157....	....	58,950	....	U. S.	
1158....	....	6,400	....	U. S.	
1159....	....	80,700	....	U. S.	
1160....	....	60,332	....	U. S.	
1161....	....	42,436	....	U. S.	
1162....	....	62,332	....	U. S.	
1163....	....	62,332	....	U. S.	
1164....	....	20,600	....	U. S.	
1165....	....	80,597	....	U. S.	
1166....	....	62,332	....	U. S.	
1167....	....	80,546	....	U. S.	
1168....	....	62,332	....	U. S.	
1169....	....	80,597	....	U. S.	
1170....	....	62,332	....	U. S.	
		1,195,891			

Summary of section 2.

Total area of agricultural land ....acres..	93.60
Total assessed value of agricultural land	$925.00
Total area of subdivided land ....square feet..	683,000
Total assessed value of private subdivided land	$9,399.00

SECTION 3.

[Agricultural land.]

No. of parcel.	Number of acres.	Rate of assessment.	Assessed value.	To whom assessed.
4......	5.62	$200.00	$1,124.00	Susan B. Sheriff.
6......	11.98	Not ass'd.	....	Adjoining Susan B. Sheriff.
7......	68.20	Not ass'd.	....	Adjoining Virginia Douglass.
	27.62	Not ass'd.	....	Adjoining Wm. B. Webb.
8......	18	5.00	90.00	Wm. B. Webb.
9......	11.46	Not ass'd.	....	Adjoining John F. Waggaman.
10......	9.62	20.00	192.00	Wm. B. Webb.
11......	26.32	Not ass'd.	....	Adjoining John W. Ross.
12......	5	50.00	250.00	Wm. B. Webb.
13......	24.12	15.00	362.00	Adjoining James H. Vermelye and Joseph B. Bailey.
14......	3.75	100.00	375.00	Wm. B. Webb.
15......	3.80	75.00	285.00	Adjoining Andrew Piggini.
16......	.63	100.00	63.00	Wm. B. Webb.

List of lands assessed in the names of private persons within the limits of the proposed improvement of Anacostia River—Continued.

SECTION 3—Continued.

[Agricultural land.]

No. of parcel.	Number of acres.	Rate of assessment.	Assessed value.	To whom assessed.
17	5.70	$75.00	$427.00	Adjoining Caroline J. Dougherty.
18*a*	.84	200.00	168.00	Jacob Beck.
18	10.90	50.00	545.00	Wm. B. Webb.
19	42.20	....	U.S.	Adjoining United States Reform School farm.
20	6.21	20.00	124.00	Wm. B. Webb.
21	10.36	50.00	518.00	Adjoining Wm. K. Boyle.
22	37.14	5.00	186.00	Washington Jockey Club.
24	57	Not ass'd.	....	Adjoining T. R. Brightwell, and H. M. Fowler, and Thos. J. Naylor and Henrietta M. Brightwell.
26	6	150.00	900.00	T. R. Brightwell.
28	4.96	125.00	620.00	H. M. Fowler.
30	.04	125.00	5.00	Thos. J. Naylor and Henrietta M. Brightwell.
32	13.34	5.00	67.00	Josephine E. Stone.
34	14.50	5.00	72.00	W. B. Shaw.
36	68	Not ass'd.	....	Adjoining E. V. McCormick.
38	4.26	90.00	383.00	E. V. McCormick.
	455.37	....	6,756.00	

[Subdivided lands.]

No. of square.	Number of square feet.	Rate of assessment.	Assessed value.	To whom assessed.
1	75,935	$0.0025	$190.00	John F. Waggaman. (Robt. Morris's addition to Washington.)
2	71,058.6	.0025	178.00	
5	12,000	.0050	60.00	
6	160,877	.0025	402.00	
7	276,886.5	.0025	692.00	
8	258,851	.0025	647.00	
9	23,800	.0025	59.00	
14	750	.0025	2.00	
15	107,263	.0025	268.00	
	987,421.1	....	2,498.00	

Summary of section 3.

Total area of private agricultural land affected	acres	455.37
Total value of private agricultural land affected		$6,756.00
Total area of subdivided land affected	square feet	987,421.10
Total value of subdivided land affected		$2,498.00

K 17.

ESTABLISHMENT OF HARBOR LINES IN POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

REPORTS OF MAJOR CHAS. E. L. B. DAVIS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., August 15, 1894.

GENERAL: In accordance with instructions contained in Department letter of February 21, 1893, inviting my attention to the provision of the river and harbor act of August 2, 1882, with reference to the establishment of harbor lines in the Potomac River in the vicinity of Washington, I have the honor to submit herewith a tracing[1] of map showing the harbor lines respectfully recommended by me to be established by the Secretary of War under the terms of the act mentioned and under the provisions of the river and harbor act of September 19, 1890.

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[1] Not printed.

The line laid down on the map is that of the lower edge of the stone retaining wall built around the filled-in area where it meets the plane of mean low water, except where the line crosses the sewer canal and the inlet of the tidal reservoir, in the latter cases being the prolongation of the line; the line is, therefore, a bulkhead line. As no wharves or piers are to be built on this area, no pierhead line is put down.

Section 6 of the act of August 5, 1886, prohibits the expenditure of money for the establishment of harbor lines upon property in respect to which there is any claim adverse to the title of the United States, and as the litigation that has now been pending for many years involves the question of ownership of the wharf frontage of the city of Washington, no bulkhead or pierhead lines are laid down for the city side of the Washington Channel.

The lengths of the chords, the arcs, and the radii of curvature are computed, and the bearings are true, not magnetic.

The following is the description of the bulkhead line from Easbys Point around the reclaimed area to the girder bridge crossing of the Pennsylvania Railway Company:

Beginning at a point, A', on the northeasterly margin of the Potomac River, at Easbys Point, near the foot of Twenty-seventh street northwest, whence a point known as A on the boundary line of Potomac Flats bears N. 77° 30' E. and is distant 9.00 feet, said point A being situated on line 1-2 of the boundary of Potomac Flats and being distant 140 feet N. 74° 12' E. from point 1, at the southeast corner of Littlefield's (formerly Easby's) wharf; and also distant 135.80 feet S. 74° 12' W. from point 2, which is marked by an iron bolt 1 inch in diameter and 18 inches long, set in the ground, which point 2 is a point in the south boundary of the square south of square 12 of the city of Washington, D. C.; thence from A' on a curve convex to the channel of the Potomac River, with a radius of 2,699 feet and a chord bearing S. 21° 01' E. and 799.74 feet long; thence on a curve convex to the channel with a radius of 5,738.65 feet and a chord bearing S. 31° 37' E. and 417.96 feet long; thence on a tangent line S. 33° 42' E. 1,189.58 feet; thence S. 36° 33' E. 1,182.58 feet; thence S. 40° 52' E. 1,010.72 feet; thence S. 46° 07' E. 908.56 feet; thence S. 49° 48' E. 1,047.61 feet; thence S. 54° 52' E. 998.20 feet; thence on a tangent curve concave to the channel, with a radius of 6,602.13 feet and a chord bearing S. 53° 34' E. and 299.66 feet long; thence on a curve intersecting the last-described line and concave to the channel, with a radius of 4,045.05 feet and a chord bearing S. 50° 34' E. and 399.05 feet long; thence on a tangent line S. 47° 45' E. 297.57 feet to a point called J', which is marked by a crosscut on the coping at the extreme west corner of the north abutment of the part of Long Bridge crossing the Virginia Channel; thence on a curve concave to the channel of the river, intersecting the last line at J', with a radius of 8,915.13 feet and a chord bearing S. 39° 48' E. and 2,152.36 feet long; thence on a tangent curve having a radius of 10,553.63 feet and a chord bearing S. 27° 51' 30'' E. and 1,842.77 feet long; thence on a tangent line bearing S. 22° 51' E. 4,324.10 feet; thence on a curve around the southern extremity of Potomac Flats at the junction of the Virginia Channel with the Washington Channel, intersecting the last-described line, with a radius of 129.70 feet and a chord bearing N. 77° 39' E. and 254.66 feet long; thence along the westerly margin of the Washington Channel, on a right line intersecting the last-described line, N. 1° 23' W. 4,097.90 feet; thence on a curve intersecting the last-described line, and convex to the channel, with a radius of 2,275.26 feet and a chord bearing N. 9° 04' W. and 593.44 feet long; thence on a right line intersecting the last-described line, N. 16° 40' W. 1,255.22 feet; thence on a curve convex to the channel and intersecting the last-described line, with a radius of 2,006 feet and a chord bearing N. 24° 38' W. 556.63 feet long; thence on a right line intersecting the last-described line, N. 32° 37' W. 511.48 feet; thence on a tangent curve convex to the channel, with a radius of 2,553.70 feet and a chord bearing N. 35° 10' W and 227.23 feet long; thence on a tangent curve convex to the channel, with a radius of 2,382.80 feet and a chord bearing N. 42° 06' W. and 364.24 feet long; thence on a tangent line N. 46° 29' W. 1,905.39 feet; thence N. 23° 26' W. 590.10 feet to a point at the southeast corner of the coping stone of the lower step of the south wing of the southwest abutment of the Pennsylvania Railroad Company's bridge across the Washington Channel, being also at the intersection of the low-water plane with the face of the wing wall at the southern end; whence a monument called V bears S. 18° 41′ W., distant 93.92 feet.

Very respectfully, your obedient servant,

CHAS. E. L. B. DAVIS,
Major, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[Seventh indorsement.]

WAR DEPARTMENT, *August 15, 1899.*

Approved in accordance with the recommendation of the Chief of Engineers in letter of July 1, 1899, and of the Commissioners of the District of Columbia in letter of August 8, 1899.

ELIHU ROOT,
Secretary of War.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., December 30, 1895.

GENERAL: In compliance with the instructions contained in Department indorsement of August 16, 1894, I have the honor to submit the following additional report and recommendations in regard to bulkhead lines along the water front of the city of Washington on the Washington Channel between the Long Bridge at the foot of Fourteenth street west and the junction of the Anacostia and Potomac rivers off the lower end of the United States Arsenal grounds (Reservation No. 5).

The Washington Channel water front between the Long Bridge at Fourteenth street west and the upper end of the Arsenal grounds at P street south is occupied by a heterogeneous collection of wharves of varied shapes, widths, lengths, and construction. Some of these are open pile wharves, but most of them are solid, being built with faces of timber, crib work, or stone and filled in with earth. Most of the wharves have buildings upon them. The existing bulkheads are irregular in line and of similarly varied construction. Water street, which extends along the entire front from Fifteenth street west to P street south, has numerous car tracks upon it, while its westerly side is lined with wooden storehouses and other buildings, many of them projecting beyond the line of the street as established February 22, 1839, by the President of the United States. In view of the existing conditions it was evident that no intelligent action could be taken without a detailed survey of this entire front and the preparation of a working map showing the location of the various wharves, buildings, etc., as well as Water street and the adjacent squares of the city. As no special funds were available for this work, it was deemed advisable, in the interest of economy, to have this survey made by the regular field party employed on the Potomac river improvement at such times as it could be spared from the current duties in connection with the contracts and construction in progress. Some of the field work had already been executed, but the pressure of other work was so great that it was necessary to defer most of it until the working season of 1895. The field work was completed in July, 1895. It was then necessary to utilize the favorable weather for the survey of the proposed bridge across the Anacostia River, so that the subsequent preparation of the working map and determination of the lines have been delayed in consequence.

Inasmuch as the decision of the supreme court of the District of Columbia in the Potomac Flats Case rendered October 17, 1895, if confirmed by the Supreme Court of the United States, will place the jurisdiction of the wharves along the Washington Channel in the hands of the Commissioners of the District of Columbia, it was deemed advisable to consult with the Engineer Commissioner as to the location of the proposed bulkhead line, and this course was adopted.

The Commissioners have also, at the request of this office, caused the corners of the several squares fronting on Water street to be laid out and marked by the surveyor of the District of Columbia. Water street has three general directions along the Washington Channel, bearing (in passing up the channel) first to the west of north, then about northwest, and then about north of west. It was found that the sides of the contiguous squares fronting on any one section of Water street were not in a mathematically straight line, so that in the description which follows reference is made to the corners of the squares at the termini of the several sections of the street to avoid ambiguity in future surveys, maps, etc.

The determining factor in the establishment of the bulkhead line is the width required for traffic along Water street. The lower part of Water street between Seventh street west and P street south is largely used for street-car traffic, and no less than three lines, having five tracks, have their termini here, thus affording convenient connection with the various lines of steamers navigating the Potomac River. Between these tracks and the river space should be provided for access to the various wharves by teams hauling freight. The Engineer Commissioner is of the opinion that the future demands of trade may require an additional track for the hauling and transshipment of freight to and from the various steam railroad lines. It was found that on the lower part of Water street a width of 120 feet measured from the northeasterly side will be sufficient for the above-mentioned purposes. Between the foot of Seventh street west and the foot of Eleventh street west there are but two car tracks and a less width might suffice for some years, but with a view to future development it is desirable that the same width of 120 feet should be provided on this section and also on the next section up to Thirteen-and-a-half street west near the Long Bridge. Where the lines thus bounding the three sections of Water street join, a slight increase in width is regarded as necessary in order to provide ample room for the curvature of railroad tracks as well as traffic.

Bulkhead lines laid down as above indicated do not vary greatly from the existing bulkheads upon the lower section of Water street, and do not, therefore, infringe materially upon the existing tidal space in the channel. Along the upper sections of Water street, where the wharves are for the most part solid, a material increase in the tidal space will be secured when the bulkhead is built and open pile wharves are substituted for those now filled in. Along the Arsenal grounds (Reservation No. 5) the existing wall furnishes a desirable bulkhead line for the upper half of the reservation, while the general line of this bulkhead extended to the initial point of the wharf line of the Anacostia River will rectify the irregularities in the Arsenal wall and improve existing conditions. It is proposed to fill in the triangular space at the junction of the two rivers, as a shoal naturally forms here and the space is not needed for wharfage.

Lines have been laid down on the working map in accordance with the above general principles and found to be entirely practicable. They have been transferred to the general map herewith which accompanied the report of August 15, 1894, and are respectfully recommended for adoption. In the description which follows bearings and distances along Water street have been purposely omitted as the lines should be laid out parallel to and 120 feet from the northeast line of Water street.

DESCRIPTION OF BULKHEAD LINES.

Commencing at the southeast corner of the southeast wing wall of the northeast abutment of the bridge built by the Baltimore and Potomac Railroad Company across the Washington Channel at a point marked *a* on the accompanying map and running thence in a straight line to a point marked *b* on the map, said point *b* being the extreme westerly corner of the stone work of the old wharf near the foot of Thirteen-and-a-half street west, formerly known as Riggs Wharf, and also a terminus of a boundary line of the Potomac Flats as established by the Secretary of War and shown on the map; thence from said point *b* along said boundary line in a straight line marked *b c* on the map to a point marked *c* at the intersection of said boundary line with the line *c d*, hereinafter next described; thence from this point *c* in a straight line marked *c d* on the map, parallel to and 120 feet distant at right angles from the northeasterly line of the part of Water street between Thirteen-and-a-half street and Twelfth street (said northeasterly line of said part of Water street being determined for the purposes of this description, by a straight line joining the southwest corner of square 270 and the southeast corner of square 300), to a point *d* shown on the map and distant 150 feet northwesterly from the intersection of the line *c d* extended with the line *e f*, hereinafter described extended in a northwesterly direction; thence from said point *d* in a straight line marked *d e* on the map to a point marked *e*, 150 feet southeasterly from said intersection of the lines *c d* and *e f* extended; thence from said point *e* in a straight line marked *e f* on the map, parallel to and 120 feet distant at right angles from the northeasterly line of that part of Water street lying between Twelfth street west and Seventh street west (said northeasterly line of said part of Water street being determined for the purposes of this description by a straight line joining the extreme west corner of square 329 and the extreme south corner of square west of 471) to a point marked *f* on the map, said point *f* being distant 200 feet northwesterly from the intersection of the line *e f* extended southeasterly with the line *g h*, hereinafter described, extended in a northwesterly direction; thence from said point *f* in a straight line marked *f g* on the map to a point *g*, 200 feet southeasterly from the above-mentioned intersection of the lines *e f* and *g h*; thence from said point *g* in a straight line marked *g h* on the map, parallel to and 120 feet distant at right angles from the northeasterly line of that part of Water street lying between Seventh street west and P street south (said northeasterly line of said part of Water street being determined for the purposes of this description by a straight line joining the northwest corner of square 472 and the southwest corner of square 504), to a point *h* at the intersection of said line *g h* with the face of the existing bulkhead wall of Reservation No. 5; thence from said point *h* along the existing bulkhead wall of Reservation No. 5 in a straight line marked *h i* on the map to a point marked *i*, said point *i* being the first angle in the bulkhead wall below the south line of P street south; thence from said point *i* in a straight line marked *i k* on the map to a point marked *k* on the wharf line of the Anacostia River as approved by the Secretary of War, May 21, 1892, said point *k* bearing S. 7° 18′ W. and distant 827.3 feet from the location of a monument marked *c* on Reservation No. 5.

It is further recommended that so much of the wharf line of the Anacostia River as lies south of Reservation No. 5 shall be regarded as a bulkhead line subject to such modifications as may be found convenient and economical in the construction of a wall, in order that the triangular area thus inclosed may be filled in as contemplated by the plans for the improvement of Anacostia River.

The wharf line shown on the map along the Washington Channel was recommended by the Board of Engineers on the Improvement of the Potomac River (see Senate Ex. Doc. No. 126, Forty-seventh Congress, first session, pages 6 and 12), and is understood to have been adopted by Congress in approving the plan of improvement by the act of August 2, 1882. This line is described as follows:

Commencing at a point 25 feet outside the northwest corner of Riggs's wharf, running thence in a straight line to a point 15 feet outside the southwest corner of the lower wharf of the Great Falls Ice Company; thence in a straight line to a point 25 feet outside the southwest corner of Evans's stone wharf; thence in a straight line to a point 25 feet outside the northwest corner of the third wharf below the Alexandria Ferry Company's slip; thence in a straight line to the southwest corner of the wharf of the Inland and Seaboard Company, and continuing to a point 140 feet above the first angle in the Arsenal wall and 220 feet west of said wall; thence to a point 130 feet outside the Arsenal wall at the site of the old penitentiary wharf; thence to a point 10 feet west of the northwest corner of the existing Arsenal wharf.

The sea wall (and bulkhead line) on the southwesterly side of the Washington Channel, bounding Section III of the reclaimed area, is substantially parallel to the above-mentioned wharf line. The entire space between these two lines is required for the turning and navigation of steamers.

The space between the proposed Water street bulkhead line and the wharf line shown will afford wharves and slips with depths ranging from 167 to 275 feet, which is regarded as sufficient.

Very respectfully, your obedient servant,

CHAS. E. L. B. DAVIS,
Major, Corps of Engineers.

Brig. Gen. W. P. CRAIGHILL,
Chief of Engineers, U. S. A.

[Second indorsement.]

WAR DEPARTMENT, *August 15, 1899.*

Approved in accordance with the recommendation of the Chief of Engineers, in letter of July 1, 1899, and of the Commissioners of the District of Columbia, in letter of August 8, 1899.

ELIHU ROOT,
Secretary of War.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, July 8, 1899.

SIR: Inviting attention to act of Congress of March 3, 1899, entitled "An act relative to the control of wharf property and certain public spaces in the District of Columbia," and particularly to section 3 of the act, I have the honor to advise you that the question of harbor lines along the Potomac River at Washington has been under consideration by the Engineer Department for a number of years, the establishment of such lines having been authorized by the river and harbor act of August 2, 1882. Reports on the subject were submitted in 1894 and 1895 by Maj. Charles E. L. B. Davis, Corps of Engineers, then in charge of the Potomac River improvement, and the matter has also recently been examined into by Lieut. Col. Charles J. Allen, Corps of Engineers, now in charge of said work, and by the Chief of Engineers. A copy of the map upon which the lines proposed are indicated is sent herewith, together with copies of the reports describing said lines and setting forth the views and recommendations of the local engineer officers.

The matter is brought to the attention of the Commissioners of the District of Columbia for such action as they may think proper under the act of March 3, 1899, with a view to presenting the same for final action of the Secretary of War.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. JOHN B. WIGHT,
President of the Board of Commissioners
of the District of Columbia, Washington, D. C.

LETTER OF THE COMMISSIONERS OF THE DISTRICT OF COLUMBIA.

OFFICE COMMISSIONERS OF THE
DISTRICT OF COLUMBIA,
Washington, August 8, 1899.

SIR: The Commissioners of the District of Columbia have the honor to notify you, pursuant to the provisions of section 3 of the act of Congress "relative to the control of wharf property and certain public spaces in the District of Columbia," approved March 3, 1899, that they concur in the determination of the harbor lines of the Potomac River at Washington as shown upon the map transmitted to them by your communication of the 8th ultimo.

Very respectfully,

JOHN B. WIGHT,
President, Board of Commissioners, D. C.

Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, July 1, 1899.

SIR: By letter of February 21, 1893, this office directed Maj. Charles E. L. B. Davis, Corps of Engineers, then in charge of the improvement of the locality, to consider and report upon the subject of the establishment of harbor lines in the Potomac River at Washington, D. C., having in view the provisions of the river and harbor act of August 2, 1882, making appropriation for the improvement of Potomac River, and the provisions of section 12 of the act of September 19, 1890.

Major Davis gave the subject careful consideration and submitted two reports, one dated August 15, 1894, in which is described a bulkhead line extending around the area reclaimed by the United States, from Easbys Point, near the foot of Twenty-seventh street NW., to the southwest abutment of the Pennsylvania Railroad Company's bridge across the Washington Channel, the other dated December 30, 1895, in which is described a bulkhead line along the water front of the city of Washington, on the Washington Channel between the Long Bridge at the foot of Fourteenth street W. and the junction of the Anacostia and Potomac rivers off the lower end of the United States Arsenal grounds.

A map showing by full red lines the bulkhead lines described in both reports and recommended by Major Davis is also submitted.

In his report of December 30, 1895, Major Davis also recommended that so much of the wharf line of the Anacostia River as lies south of Reservation No. 5 (United States Arsenal grounds) shall be regarded as a bulkhead line, subject to such modifications as may be found convenient and economical in the construction of a wall, in order that the triangular area thus inclosed might be filled in as contemplated by the plans for the improvement of the Anacostia River.

These papers have been considered by Lieut. Col. Charles J. Allen, Corps of Engineers, the officer now in charge of the Potomac River improvement, whose report on the subject is contained in fifth indorsement on 7396 E. D. herewith.

Concurring in the views of these officers, I recommend approval by the Secretary of War of the accompanying reports and the establishment, under the provisions of section 11 of the river and harbor act approved March 3, 1899, of the lines selected.

The two reports and the map have been prepared for the signature of the Secretary.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

[NOTE.—The lines recommended by the Chief of Engineers and the Commissioners of the District of Columbia were approved by the Secretary of War August 15, 1899.]

APPENDIX L.

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

REPORT OF MAJOR THOS. L. CASEY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Norfolk, and its approaches, Virginia.
2. Elizabeth River, Virginia.
3. Western Branch of Elizabeth River, Virginia.
4. Nansemond River, Virginia.
5. Appomattox River, Virginia.
6. Harbor at Cape Charles City, Virginia.
7. Nandua Creek, Virginia.
8. Waterway from Norfolk, Virginia, to the Sounds of North Carolina.
9. Inland water route from Norfolk, Virginia, to Albemarle Sound, North Carolina.
10. Edenton Bay, North Carolina.
11. Roanoke River, North Carolina.
12. Pasquotank River, North Carolina.
13. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEY.

14. Deep Creek Branch of Elizabeth River, Virginia.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., July 19, 1899.

GENERAL: I have the honor to transmit herewith my annual report upon the works of river and harbor improvement in my charge during the fiscal year ended June 30, 1899.

Very respectfully, your obedient servant,

THOS. L. CASEY,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

L 1.

IMPROVEMENT OF HARBOR AT NORFOLK, AND ITS APPROACHES, VIRGINIA.

No work was carried on during the fiscal year ended June 30, 1899. The expenditures during the fiscal year were for outstanding liabilities June 30, 1898.

Under the title of "Improving Elizabeth River, Virginia," an appropriation of $360,000 was made in the deficiency act approved July 7, 1898, for securing a channel 450 feet wide and 28 feet deep at mean low water from Hampton Roads to the United States navy-yard near Norfolk, Va. The operations thereunder are described in a report under the title quoted.

The commerce of the harbor for the calendar year 1898 is shown in tabulated form below.

Norfolk Harbor is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house is Craney Island Light, at mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

Amount of revenue collected at port of Norfolk, Va., during the fiscal year ended June 30, 1899, $20,494.83.

Money statement.

July 1, 1898, balance unexpended	$3,719.22
June 30, 1899, amount expended during fiscal year	55.70
July 1, 1899, balance unexpended	3,663.52
Amount (estimated) required for completion of existing project	56,774.56
Amount that can be profitably expended in fiscal year ending June 30, 1901.	56,774.56

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

August 14, 1876	$35,000	August 11, 1888	$50,000
June 18, 1878	50,000	September 19, 1890	150,000
March 3, 1879	75,000	July 13, 1892	150,000
June 14, 1880	50,000	August 18, 1894	100,000
March 3, 1881	75,000	June 3, 1896	100,000
August 2, 1882	75,000		
July 5, 1884	25,000	Total	985,000
August 5, 1886	50,000		

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Harbor of Norfolk, Va., during the calendar year 1898 were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.
	Tons.	
Coal	2,072,924	$4,598,172
Fertilizers	39,506	310,713
Lumber	474,426	4,286,800
Cotton	144,900	14,490,000
Grain	221,028	4,420,560
Merchandise	3,557,417	491,847,750
Total	6,510,201	519,953,995

No accurate statement can be compiled as to the number, draft, and tonnage of vessels navigating the harbor, but it may be said that they were from the smallest to an 8,000-ton ship.

Approximate amount of freight of all kinds shipped and received by water:

Year.	Tons.	Year.	Tons.
1888	1,914,506	1894	4,545,049
1889	2,243,087	1895	5,018,185
1890	2,384,841	1896	5,986,636
1891	2,931,751	1897	9,430,526
1892	3,427,189	1898	6,510,201
1893	3,584,727		

L 2.

IMPROVEMENT OF ELIZABETH RIVER, VIRGINIA.

An item in the deficiency act, approved July 7, 1898, appropriated $360,000 for securing a channel 450 feet wide and 28 feet deep at mean now water from Hampton Roads to the navy-yard near Norfolk, Va., the funds so provided to be available until June 30, 1899.

In compliance with instructions from the Chief of Engineers, United States Army, a project covering the execution of the work was submitted on July 9, 1898, and the same was approved July 21, 1898. It was estimated that the removal of about 2,000,000 cubic yards of material, scow measurement, would be necessary to obtain the required channel and that the greater part would be soft mud. The price including inspection and contingencies was stated at 18 cents per cubic yard, scow measurement, and recommendation made that the work be done by contract after ten-day advertisement in official newspapers, the law making provision for the work limiting the time of advertisement to that period.

The work was duly advertised under date of July 14, 1898, and specifications issued covering the execution of the work and providing for the completion of a 150-foot channel, 28 feet deep at mean low water throughout, on or before November 30, 1898, and the full channel projected by June 30, 1899. The bids received were opened August 3, 1898 (abstract appended), with the result that the contract was awarded to the American Dredging Company, of Philadelphia, Pa., the lowest bidder, at 14½ cents per cubic yard, scow measurement. The contract with the company named above was executed August 12, 1898, and operations thereunder commenced August 23 and completed December 23, 1898.

Eight dredges with proper scow and tug-boat equipment were employed on the work. The total amount of material removed was 2,361,775 cubic yards, scow measurement. The material was deposited behind the Ripraps, opposite Fort Monroe, Va.

Since the dredging was done an examination of the channel has been made, which shows that the required depth has been obtained.

The cost of the improvement made may be stated as follows:

Dredging and depositing 2,361,775 cubic yards, scow measurement, of material, at 14½ cents	$342,457.38
Inspection	6,791.63
Contingencies	10,267.41
Total	359,516.42

This river is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house is Craney Island Light, at mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

Amount of revenue collected at port of Norfolk, Va., during the fiscal year ended June 30, 1899, $20,494.83.

Money statement.

Amount appropriated by deficiency act approved July 7, 1898	$360,000.00
June 30, 1899, amount expended during fiscal year	359,450.09
July 1, 1899, balance unexpended	549.91
July 1, 1899, outstanding liabilities	66.33
July 1, 1899, balance available	483.58

Appropriation.

July 7, 1898	$360,000

Abstract of proposals received for dredging the Elizabeth River, Virginia, from deep water in Hampton Roads to navy-yard, near Norfolk, Va., in response to advertisement dated July 14, 1898, and under specifications of the same date, opened by Capt. Thomas L. Casey, Corps of Engineers, at 12 o'clock noon, on August 3, 1898, at Norfolk, Va.

No. of proposal.	Name and address of bidder.	Price bid per cubic yard, scow measurement.	Amount of material that can be removed with available funds at price bid.
		Cents.	*Cubic yards.*
1	Baltimore Dredging Co., Baltimore, Md	$15\frac{4}{10}$	2,110,390
2	P. Sanford Ross, Jersey City, N. J	$14\frac{3}{4}$	2,203,390
3	Geo. Leary. New York, N. Y	$15\frac{9}{10}$	2,044,025
4	American Dredging Co., Philadelphia, Pa	$14\frac{1}{2}$	2,241,380
5	Virginia Dredging Co., Richmond, Va	$15\frac{7}{10}$	2,070,006

No. of proposal.	Bidder.	Time.			
		A channel 150 feet wide, 28 feet deep at mean low water.		A channel 450 feet wide, 28 feet deep at mean low water.	
		Commence.	Complete.	Commence.	Complete.
1	Baltimore Dredging Co	Aug. 25, 1898	Nov. 30, 1898	Oct. 1, 1898	June 30, 1899
2	P. Sanford Ross	Aug. 31, 1898, or ten days after signing contract.	....do	Same as for 150-foot channel.	Do.
3	Geo. Leary	Sept. 20, 1898	....do	Sept. 20, 1898	Do.
4	American Dredging Co	Sept. 1, 1898	....do	Sept. 1, 1898	Do.
5	Virginia Dredging Co	....do	....do	Nov. 30, 1898	Do.

Contract in force.

Name and address of contractor.	Date of approval.	Date of beginning work.	Date of expiration.
American Dredging Co., Philadelphia, Pa	Sept. 17, 1898	Aug. 23, 1898	Dec. 28, 1898

COMMERCIAL STATISTICS.

See report on improvement of harbor at Norfolk and its approaches, Virginia.

L 3.

IMPROVEMENT OF WESTERN BRANCH OF ELIZABETH RIVER, VIRGINIA.

No operations were carried on during the fiscal year and no expenditures made.

This river is in the collection district of Norfolk and Portsmouth, Va., and Norfolk, Va., is the nearest port of entry. Nearest light-house, Craney Island Light, at the mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1899, is $20,494.83.

Money statement.

July 1, 1898, balance unexpended	$581.27
July 1, 1899, balance unexpended	581.27

Appropriation.

June 3, 1896	$45,000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Western Branch of the Elizabeth River, Virginia, during the calendar year 1898 were kindly furnished by Mr. Charles O. Hains, general manager of the Atlantic and Danville Railroad:

Articles.	Amount.	Value.
	Tons.	
Iron	15,640	$156,400
Coal	4,590	13,770
Lumber	184,184	1,372,262
Wood	20,948	60,996
Ties	56	225
Miscellaneous	116,768	35,000,000
Logs	4,089	24,584
Piles	560	2,800
Total	346,835	36,630,987

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam	6	8	465
Sail	358	10½	300
Barges	1,560	11	290
Lighters	75	2½	60
Total	1,999	....	....

The New York, Philadelphia and Norfolk Railroad estabished their terminal for transshipment of cars on the south side of the river, about one-half mile above the mouth, during the fiscal year 1899.

Approximate amount of freight of all kinds shipped and received by water.

Year.	Tons.
1896	211,653
1897	244,803
1898	346,835

L 4.

IMPROVEMENT OF NANSEMOND RIVER, VIRGINIA.

No work of improvement has been done during the fiscal year ended June 30, 1899. The balance of the appropriation of June 3, 1898, and the $5,000 appropriated March 3, 1899, for the improvement will be held until an advantageous letting of work of a permanent nature can be had or the demands of navigation require temporary relief.

No expenditures were made during the fiscal year.

Nansemond River is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house, Big Point Light, at mouth of river. Nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1899, is $20,494.83.

Money statement.

July 1, 1898, balance unexpended		$4,904.63
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
July 1, 1899, balance unexpended		9,904.63
Amount (estimated) required for completion of existing project		102,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	3,500.00	
		13,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

March 3, 1873	$15,000	July 13, 1892	$10,000
March 23, 1874	10,000	August 18, 1894	10,000
March 3, 1875	5,000	June 3, 1896	5,000
March 14, 1876	5,000	March 3, 1899	5,000
June 18, 1878	2,000		
August 11, 1888	10,000	Total	87,000
September 19, 1890	10,000		

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Nansemond River, Virginia, during the calendar year 1898 were compiled from statements furnished by parties making shipments by way of this stream:

Articles.	Amount in tons.	Value.
Lumber	24,136	$241,360
General merchandise	7,660	574,500
Total	31,796	815,860

No statement of the number, draft, or tonnage of vessels navigating this river could be compiled from the information furnished by shippers.

Approximate amount of freight of all kinds shipped and received by water.

Year.	Tons.	Year.	Tons.
1888	109,900	1894	53,762
1890	217,738	1895	59,701
1891	78,572	1896	61,405
1892	133,723	1897	43,500
1893	59,473	1898	31,796

L 5.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

The work done during the fiscal year has been confined to dredging shoals in the vicinity of Rushmores Dike. Operations were commenced May 12, 1899, and were still in progress at the close of the fiscal year, when 10,250 cubic yards of material, scow measurement, had been removed and wheeled ashore, resulting in a channel 12 feet deep at mean high water, 60 feet wide for a distance of 820 feet, and 20 feet wide for an additional 350 feet.

The plant used consisted of one dipper dredge, three deck scows of 50 cubic yards capacity each, and one small tugboat. The material, which was mostly sand, with some clay at the upper ends of the cuts, was wheeled ashore, for which purpose 20 laborers were employed, the average day's work in sand being 300 cubic yards and 250 cubic yards in clay. The plant cost per day $35 dollars, making the cost of excavation on the scows, alongside of the dike, about 13.4 cents per cubic yard. The cost of wheeling material ashore was about 8.6 cents per cubic yard, or 22 cents per cubic yard for excavation and deposit combined.

The expenditures during the fiscal year have amounted to $1,876.50.

This river is in the collection district of Petersburg, Va., which is the nearest port of entry. Nearest light-house, Jordan Point Light, in the James River, Virginia. Nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Petersburg, Va., during the fiscal year ended June 30, 1899, is $2,440.78.

It is strongly recommended that a special appropriation of about $200,000 be made for the purpose of deflecting the river from a point just above the bridge at Petersburg into the old channel, beginning at that point and extending down about 2 miles. This would relieve the stream of the flood water which annually brings large quantities of silt to obstruct the channel. The estimate of cost of this improvement given in the Report of the Chief of Engineers for 1889, page 960, is evidently excessive, as a comparatively small amount of dredging would give a lead which would be rapidly enlarged by the deflected flood water.

Money statement.

July 1, 1898, balance unexpended		$4,118.54
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		9,118.54
June 30, 1899, amount expended during fiscal year		1,876.50
July 1, 1899, balance unexpended		7,242.04
July 1, 1899, outstanding liabilities		784.40
July 1, 1899, balance available		6,457.64
Amount (estimated) required for completion of existing project		48,090.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement under existing project	10,000.00	
		20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

March 3, 1871	$50,000	July 5, 1884	$25,000
June 10, 1872	40,000	August 5, 1886	18,750
March 3, 1873	30,000	August 11, 1888	15,000
June 23, 1874	30,000	September 19, 1890	15,000
March 3, 1875	30,000	July 13, 1892	15,080
August 14, 1876	30,000	August 18, 1894	5,000
June 18, 1878	30,000	June 3, 1896	5,000
March 3, 1879	20,000	March 3, 1899	5,000
June 14, 1880	20,000		
March 3, 1881	20,000	Total	438,830
August 2, 1882	35,000		

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Appomattox River, Virginia, during the calendar year 1898, were furnished by Mr. W. H. Mays, harbor master, Petersburg, Va.:

Articles.	Amount.	Value.
	Tons.	
Merchandise	62,097	$317,228
Coal	3,451	14,592
Peanuts	2,150	96,573
Fertilizers	7,876	72,328
Grain	1,831	41,885
Lumber	19,036	119,284
Total	95,941	661,890

Vessels.	Number.	Average draft.
		Feet.
Steam	802	$6\frac{5}{12}$
Sail	263	$8\frac{5}{12}$
Barges	74	9
Total	1,139	....

Approximate amount of freight of all kinds received and shipped by water.

Year.	Tons.	Year.	Tons.
1888	30,626	1892	25,218
1889	26,121	1896	81,318
1890	21,693	1897	84,031
1891	26,275	1898	95,941

L 6.

IMPROVEMENT OF HARBOR AT CAPE CHARLES CITY, VIRGINIA.

No work has been carried on during the fiscal year and no expenditures made.

The approved project for the expenditure of the appropriation of $20,000 in the act of March 3, 1899, provides for the completion of the north jetty and the commencement of the one proposed on the south side of the entrance, if the amount of the appropriation will permit.

Cape Charles City Harbor is in the collection district of Cherrystone, Va., and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort, and the nearest light-house is Cherrystone Light.

No revenue was collected at the port of Cape Charles City, Va., during the fiscal year ended June 30, 1899.

Money statement.

July 1, 1898, balance unexpended	$17.54
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
July 1, 1899, balance unexpended	20,017.54
Amount (estimated) required for completion of existing project	87,340.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	40,000.00

Appropriations.

By act approved—

September 19, 1890	$25,000
July 13, 1892	10,000
March 3, 1899	20,000
Total	55,000

COMMERCIAL STATISTICS.

The commerce of the harbor is reported to have amounted to 569,894 tons during the calendar year 1898. It was impossible to obtain any other details.

Approximate amount of freight of all kinds shipped and received by water.

Year.	Tons.	Year.	Tons.
1890	390, 207	1894	427, 728
1891	319, 164	1895	455, 269
1892	341, 269	1896	487, 004
1893	393, 352	1898	569, 894

L 7.

IMPROVEMENT OF NANDUA CREEK, VIRGINIA.

No work has been done during the fiscal year and no expenditures made.

Nandua Creek is in the collection district of Cherrystone, Va., and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort and the nearest light-house is Cherrystone Light.

No revenue was collected at the port of Cape Charles City, Va., during the fiscal year ended June 30, 1899.

Money statement.

July 1, 1898, balance unexpended	$2,988.08
Amount appropriated by river and harbor act approved March 3, 1899	3,000.00
July 1, 1899, balance unexpended	5,988.08

Appropriations.

June 3, 1896	$3,000
March 3, 1899	3,000
Total	6,000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Nandua Creek, Virginia, during the calendar year 1898, were furnished by Mr. J. C. Boggs, of Nandua, Va:

Articles.	Amount.	Value.
	Tons.	
Merchandise and farm produce	7,000	$200,000
Oysters and shells	750	9,000
Lumber	600	10,000
Coal	200	1,000
Total	8,550	220,000

Approximate amount of freight of all kinds shipped and received by water.

Year.	Tons.
1896	6,125
1897	8,436
1898	8,550

L 8.

IMPROVEMENT OF WATERWAY FROM NORFOLK, VIRGINIA, TO THE SOUNDS OF NORTH CAROLINA.

This is a new work, provision for which is made in the following extract from the river and harbor act of March 3, 1899:

> Improving Deep Creek, Virginia, from the South Branch of the Elizabeth River to the new lock at the Dismal Swamp Canal, Turners Cut Level, Croatan Sound, and Pasquotank River, North Carolina, twenty-five thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the project for the said improvement as submitted by Major Thomas L. Casey, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and thirty-two thousand four hundred and fifty dollars, exclusive of the amount herein appropriated.

No operations have been in progress during the fiscal year and no expenditures made. Specifications covering the execution of all the work of improvement contemplated have been issued, and proposals invited by advertisement June 19, 1899.

This work is in the collection district of Norfolk and Portsmouth, Va., and Albemarle, N. C., and Norfolk, Va., and Edenton, N. C., are the nearest ports of entry. Nearest light-houses, Wade Point Light, in Albemarle Sound; Croatan Light, in Croatan Sound, North Carolina, and Craney Island Light, in Elizabeth River, Virginia. Fort Monroe, Va., is the nearest fort.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1899, is $20,494.83.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$25,000.00
July 1, 1899, balance unexpended	25,000.00
Amount (estimated) required for completion of existing project	249,310.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	200,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriation.

March 3, 1899	$25,000

COMMERCIAL STATISTICS.

This improvement comprises the northern and southern outlets of the Dismal Swamp Canal. As the canal has not been opened to traffic the commerce has confined itself to that local to the different waterways of the improvement which the work contemplated is not intended to effect.

L 9.

IMPROVEMENT OF INLAND WATER ROUTE FROM NORFOLK, VIRGINIA, TO ALBEMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

Work on this improvement, in removing sunken logs from the channel between Church Island and the first beacon in Currituck Sound, was carried on with the snag boat *Roanoke* from January 9 to March 17, 1899. During the first half of February no work could be done on account of ice and severe storms, and for ten days in March the boat was under repairs at Elizabeth City, N. C. The total number of logs removed was 160. In the section of the work from the light station at Long Point, North Carolina, northward to the first beacon in the sound, the removal of logs could not be accomplished without delay, as it was necessary to drive by hand small piles on every move in order to hold the snag boat in position by means of lines.

The expenditures during the year amounted to $1,457.03, of which $1,369.22 was applied to removing logs and the balance to administrational expenses.

This work is in the collection district of Norfolk and Portsmouth, Va., and Albemarle, N. C., and Norfolk, Va., and Edenton, N. C., are the nearest ports of entry. Nearest light-house, Long Point Light, in Coinjock Bay, North Carolina. Fort Monroe, Va., is the nearest fort.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1899, is $20,494.83.

Money statement.

July 1, 1898, balance unexpended		$1,469.37
Amount appropriated by river and harbor act approved March 3, 1899		8,000.00
		9,469.37
June 30, 1899, amount expended during fiscal year		1,457.03
July 1, 1899, balance unexpended		8,012.34
Amount (estimated) required for completion of existing project		21,667.08
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$21,667.08	
For maintenance of improvement	1,800.00	
		23,467.08
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

For Southern Branch Elizabeth River, Virginia—	
March 3, 1873	$15,000.00
June 23, 1874	10,000.00
March 3, 1875	5,000.00
August 14, 1876	5,000.00
June 18, 1878	5,000.00
For North Landing River, Virginia and North Carolina—	
March 3, 1879	25,000.00
June 14, 1880	15,000.00
March 3, 1881	7,500.00
August 2, 1882	8,000.00
For Currituck Sound, Coinjock Bay, and North River Bar, North Carolina—	
June 18, 1878	20,000.00
March 3, 1879	25,000.00
June 14, 1880	25,000.00
March 3, 1881	30,000.00
For Currituck Sound, Coinjock Bay, and North River Bar, North Carolina—Continued.	
August 2, 1882	$20,000.00
July 5, 1884	5,000.00
August 5, 1886	10,000.00
August 11, 1888	7,500.00
For inland water route, etc.—	
September 19, 1890	10,000.00
July 13, 1892	9,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	8,000.00
Total	285,000.00
Amount received from sale of property to other works	2,169.69
Aggregate	287,169.69

COMMERCIAL STATISTICS.

The following statistics, relative to the commerce of the inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina, during the calendar year 1898, were compiled from a statement furnished by the Albemarle and Chesapeake Canal Company:

Articles.	Amount.	Value.
	Tons.	
Lumber	142,368	$1,695,246
Guano	14,415	275,000
Cotton	1,472	163,500
Oysters and fish	6,941	40,869
Produce	6,014	50,958
Merchandise	17,363	389,386
Total	188,573	2,614,959

Vessels.	Number.	Average draft.	Average tonnage.
		Feet.	
Steam	2,828	3 to 8½	61
Sail	1,482	1 to 8½	51
Barges	1,219	4 to 8	235
Lighters	77	1 to 2	35
Do	303		
Total	5,909		

Approximate amount of freight of all kinds passing through this route.

Year.	Tons.	Year.	Tons.
1888	335,758	1894	285,455
1889	372,617	1895	324,866
1890	403,111	1896	322,947
1891	328,609	1897	301,055
1892	281,542	1898	188,573
1893	296,520		

L 10.

IMPROVEMENT OF EDENTON BAY, NORTH CAROLINA.

The authority of the Chief of Engineers, United States Army, was obtained May 27, 1899, for the expenditure of the available balance of the appropriation of July 5, 1884, and the amount appropriated August 5, 1886, aggregating $2,447.41, in dredging, under the project under which operations were previously carried on, from the Town wharf to the first beacon outward. No work has been done or expenditure made during the fiscal year. Proposals for the dredging will be invited early in the fiscal year 1900.

This improvement is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Roanoke River Light, North Carolina.

No revenue was collected at the port of Edenton, N. C., during the fiscal year ended June 30, 1899.

Money statement.

July 1, 1898, balance unexpended	$2,447.41
July 1, 1899, balance unexpended	2,447.41
Amount (estimated) required for completion of existing project	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	6,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

By act approved—

June 18, 1878	$4,000
March 3, 1879	1,000
July 5, 1884	10,000
August 5, 1886	2,000
Total	17,000

COMMERCIAL STATISTICS.

The commerce is reported to have amounted to 160,109 tons during the calendar year 1899. Other details could not be obtained.

L II.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA.

Work on this improvement in the removal of channel obstructions was carried on during October 15 to December 21, 1898, inclusive, and April 1 to June 30, 1899, inclusive, with the snag boat *Roanoke*. During the periods stated 64 trees, 5 snags, 50 stumps, and 6 logs were removed and placed on the banks. Some slight repairs were made to the snag boat, the machinery given a thorough overhauling, and the woodwork painted inside and out, most of this work being done by the crew of the boat.

The expenditures during the fiscal year ended June 30, 1899, amounted to $4,131.49 for removing obstructions, repairs to snag boat, and contingent expenses.

This river is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Roanoke River Light, North Carolina, at mouth of river. Nearest fort, Fort Monroe, Va.

No revenue was collected at the port of Edenton, N. C., during the fiscal year ended June 30, 1898.

Money statement.

July 1, 1898, balance unexpended	$35,694.01
June 30, 1899, amount expended during fiscal year	4,131.49
July 1, 1899, balance unexpended	31,562.52
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	41,600.00

Appropriations.

March 3, 1871	$20,000	July 13, 1892	$50,000
June 10, 1872	10,000	August 18, 1894	30,000
March 3, 1873	10,000	June 3, 1896	10,000
June 23, 1874	5,000		
August 2, 1882	5,000	Total	228,000
July 5, 1884	3,000	Amount received from sale of property to other works	1,338
August 5, 1886	20,000		
August 11, 1888	40,000		
September 19, 1890	25,000	Aggregate	2

COMMERCIAL STATISTICS.

A full statement of the commerce could not be secured for the calendar year 1898. The replies received show an aggregate of 22,429 tons of freight carried on the river during 1898.

Approximate amount of freight of all kinds received and shipped by water.

Year.	Tons.	Year.	Tons.
1870	150,000	1892	42,039
1890	182,700	1893	121,024
1891	876,181		

L 12.

IMPROVEMENT OF PASQUOTANK RIVER, NORTH CAROLINA.

No operations were under way on this improvement during the fiscal year, as the small balance available would not permit of any work being done.

This work is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Wade Point Light, at mouth of river. Fort Monroe, Va., is the nearest fort.

No revenue was collected at the port of Edenton, N. C., during the fiscal year ended June 30, 1899.

Money statement.

July 1, 1898, balance unexpended	$4.57
July 1, 1899, balance unexpended	4.57

Appropriations.

March 2, 1829	$80.00
September 19, 1890	3,000.00
July 13, 1892	3,000.00
August 18, 1894	1,000.00
Total	7,080.00
Amount turned in to surplus fund of the Treasury	32.75
Aggregate	7,047.25

COMMERCIAL STATISTICS.

It is impossible to secure an accurate statement of the amount or value of the commerce of the improvement, which is mostly carried on by pole and flat boats making irregular and infrequent trips.

L 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wrecks of barges C. C. Chapman and Washington.—These barges were wrecked on the Tail of the Horseshoe, Chesapeake Bay, 6¼ miles northwest from Cape Henry, in about 21 feet of water.

Their removal was authorized August 22, 1898, at a cost of $5,500. Bids for the work were invited by public notice of September 14, 1898, and were opened September 24, 1898. The bids of Mr. Charles W. Johnston, of Lewes, Del., were the lowest, at $1,600 for the *C. C. Chapman* and $900 for the *Washington.* A contract at these figures was entered into with him on October 10, 1898, and the same received the approval of the Chief of Engineers October 24, 1898.

The contractor commenced work in destroying the wrecks on October 15, and had completed the work November 3, 1898. The total cost of disposing of both wrecks was $2,800; $2,500 paid the contractor and $300 for inspection and contingencies.

Abstract of proposals for removing wrecks of barges C. C. Chapman and Washington, lying in lower Chesapeake Bay, Virginia, received in response to public notice dated September 14, 1898, and under specifications of same date opened at United States engineer office, 166 Granby street, Norfolk, Va., by Capt. Thomas L. Casey, Corps of Engineers, at noon on September 24, 1898.

No.	Name and address of bidder.	Barge C. C. Chapman.	Barge Washington.	Aggregate of bids for both wrecks.
1	Enoch Townsend, Linwood, N. J	$2,805	$2,055	$4,360
2	Charles W. Johnston, Lewes, Del	1,600	9,000	2,500

Abstract of contract in force.

Name and residence of contractor.	Date of approval of contract.	Date of beginning work.	Date of expiration.
Charles W. Johnston, Lewes, Del	Oct. 24, 1898	Oct. 15, 1898	Nov. 3, 1898

L 14.

DREDGING DEEP CREEK BRANCH, ELIZABETH RIVER, VIRGINIA.

[Printed in House Doc. No. 131, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 7, 1899.

SIR: I have the honor to return herewith House concurrent resolution No. 18, Fifty-fifth Congress, third session, passed the House December 20, 1898, and concurred in by the Senate December 21, 1898, which directs the Secretary of War to prepare and submit an estimate of the cost of widening and deepening Deep Creek, Virginia, from the South Branch of the Elizabeth River to the new lock at the Dismal Swamp Canal.

In reply to the reference of the resolution to this office, I have to state that Maj. Thomas L. Casey, Corps of Engineers, the local officer, estimates that the cost of excavating a 10-foot channel 100 feet wide in Deep Creek from South Branch to the Deep Creek Lock of the Dismal Swamp Canal will be, including contingencies, $85,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

APPENDIX M.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, CAPT. W. E. CRAIGHILL AND CAPT. E. W. VAN C. LUCAS, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Ocracoke Inlet, North Carolina.
2. Fishing Creek, North Carolina.
3. Pamlico and Tar rivers, North Carolina.
4. Contentnia Creek, North Carolina.
5. Trent River, North Carolina.
6. Neuse River, North Carolina.
7. Inland waterway between Newbern and Beaufort, North Carolina.
8. Harbor at Beaufort, North Carolina.
9. Inland waterway between Beaufort and New River, North Carolina.
10. New River, North Carolina.
11. Black River, North Carolina.
12. North East (Cape Fear) River, North Carolina.
13. Cape Fear River above Wilmington, North Carolina.
14. Cape Fear River at and below Wilmington, North Carolina.
15. Town Creek, North Carolina.
16. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 19, 1899.

GENERAL: I have the honor to submit herewith * * * my annual report for the year 1899.

* * * * * * *

Very respectfully, your obedient servant,

E. W. VAN C. LUCAS,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

M 1.

IMPROVEMENT OF OCRACOKE INLET, NORTH CAROLINA.

For description and previous history, see Annual Reports, page 1359 of 1893, page 996 of 1894, and page 1097 of 1896.

The improved channel crosses shoals at Beacon Island Slough and Royal Shoal, the former with an original depth of 7 feet and the latter with an original depth of 4½ feet. Cuts 9 feet deep and 300 feet bottom width were dredged through both in 1895–96. The cut at Beacon Island Slough shoaled to approximately its original condition and depth within a year after the completion of the dredging, while the Royal Shoal Cut shoaled approximately five-tenths of a foot annually since then. It seems therefore a fair conclusion that a depth greater than 7 feet at mean low water can not be maintained in Beacon Island

Slough without some form of regulating work, while the cut through Royal Shoal can probably be maintained by occasional redredging every few years.

An examination made in June, 1899, showed low-water depths of 12 feet on the ocean bar with good channels to sheltered anchorage inside, 7 feet at Beacon Island Slough and 8.2 feet in Royal Shoal Cut. The tidal range on the bar is 3.5 feet; at Beacon Island Slough 1.5, and at Royal Shoal Cut about two-tenths feet, giving a high-water depth on the bar of 15.5 feet and a channel thence to the sound practicable for vessels of about 8 feet draft. A draft of 8 feet is the greatest that can at present be carried to ports in Albemarle and Pamlico sounds, and the channel at Ocracoke has therefore sufficient depth for the present needs of navigation, but shoaling in the Royal Shoal Cut will probably reduce the practicable channel depth to 7 feet within the next two years, and the channel up Pamlico River to Washington, N. C., will be deepened to 9 feet within the next year.

No complaints have been received from vessel owners or captains on account of the shoaling at Ocracoke.

No commercial statistics have been kept at this place and it has been found impossible to make even an approximate estimate of the commerce using the inlet during the last year. From all available reports, however, it appears that the number of lumber schooners using the inlet is steadily decreasing. There are some indications, however, that its use as the southern terminus of the inland water route for vessels drawing between 5 and 8 feet is increasing.

This inlet is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1898, balance unexpended	$16,289.44
June 30, 1899, amount expended during fiscal year	20.91
July 1, 1899, balance unexpended	16,268.53
July 1, 1899, outstanding liabilities	29.65
July 1, 1899, balance available	16,238.88

Appropriated.

March 20, 1826, to March 3, 1837	$133,750.00
September 19, 1890	90,000.00
July 13, 1892	15,000.00
	238,750.00
Less amount carried to surplus fund	17.60
	238,732.40

COMMERCIAL STATISTICS.

Freight transported.

Calendar year ending December 31—		
1890, estimated	tons	15,000
1891, estimated	do	15,000
1892		(1)
1893		(1)
1894		(1)
1895, estimated	tons	30,223
1896, estimated	do	50,000
1897, estimated	do	43,741

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[1] Not estimated.

M 2.

IMPROVEMENT OF FISHING CREEK, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects, see Annual Report for 1896, page 1100.

In December, 1896, the provision of the appropriation act that the money should not be available until draws were provided in the bridges that were unreasonable obstructions to navigation had been complied with, and work by hired labor and the use of the United States plant was then commenced.

At the beginning of the fiscal year the creek had been cleared for 19 miles, commencing at its mouth.

The following extract from report of Assistant Engineer W. H. Chadbourn, jr., in local charge, gives details of work during the past fiscal year:

> The work during the year has consisted of removing snags and logs from the channel and clearing overhanging trees from the banks. The creek has been cleared to Coffields Bridge, 21.3 miles from the mouth. The hoister *Pamlico* was withdrawn in December, having been at work in the creek for nearly two years. At that date the creek to Coffields Bridge was in very good condition, scarcely a snag in the channel, but a few overhanging trees still interfering. A little work has been done by hand since withdrawal of machine, removing snags that washed in, and cutting overhanging trees.
>
> An inspection in June shows a number of trees fallen in from the banks and some logs and snags in the channel. It would be impossible for a steamboat to navigate the creek at present.
>
> There have been removed during the year from the channel 2,096 large snags, 198 stumps, 330 trees, 55 logs, and 10 cords small snags, and from the banks 260 trees and 8 stumps hauled back, 44 trees trimmed, and 64 cords of brush cut.
>
> The stern-wheel steamer *Tarboro*, of about 50 tons capacity, has been built to run on this stream, and made a number of trips this spring. The highest point it went to was 17-mile post, except on a trial trip when it went to 19-mile post. It seems at present that the 17-mile post will be as high as the steamer will usually run, with perhaps an occasional trip to Coffields Bridge; and it does not appear that it would run beyond that point if the stream is cleared. The principal shipping point now is Mayos Landing, near 15-mile post. It takes the steamer a whole day to ascend to this point from Tarboro, the navigation is so tortuous and tedious.
>
> This creek is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1898, balance unexpended	$2,628.16
Amount appropriated by river and harbor act approved March 3, 1899	7,750.00
	10,378.16
June 30, 1899, amount expended during fiscal year	2,399.56
July 1, 1899, balance unexpended	7,978.60
July 1, 1899, outstanding liabilities	22.33
July 1, 1899, balance available	7,956.27
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriated.

September 19, 1890	$10,000
July 13, 1892	5,000
March 3, 1899	7,750
Total	22,750

COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.
Timber	3,375
Cotton	108
Cotton-seed meal	59
Total	3,542

Gain over last year, 1,082 tons. Transportation lines established during the year, 1

Freight transported.

	Tons.
Calendar year ending December 31—	
1896	1,000
1897	2,460

Statement of vessels navigating Fishing Creek, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamer	2	55	2
Flats	1	50	1.5

M 3.

IMPROVEMENT OF PAMLICO AND TAR RIVERS, NORTH CAROLINA.

[One river, called the Pamlico below and the Tar above Washington.]

For previous history of this improvement and detailed statements of projects, see Annual Report of Chief of Engineers for 1896, page 1101.

Details of present condition and work during the year are given in the following extract from report of Assistant Engineer W. H. Chadbourn, jr., in local charge:

The operations during the year ending June 30, 1899, have been carried on by hired labor and the use of United States plant.

The work during the year has consisted of removing snags and logs from the channel and clearing overhanging trees from the banks. Obstructions were removed from the river above Washington to the mouth of Fishing Creek between December and May as follows:—

From the channel 348 snags, 46 logs, 68 stumps, 93 trees, and from the banks, 99 trees hauled back, 10 trees trimmed, and 4 cords of brush cut.

A recent inspection shows quite a number of logs in the river below the 38-mile post. There are two large log landings in the vicinity, and by careless handling many sunken or partially sunken logs get into the channel and work downstream, making navigation dangerous. A recent freshet caused several rafts to go to pieces because of carelessness, and many hundreds of logs are apparently abandoned and in such positions as to be likely to get into the channel.

It is recommended that these logs be cleared out at an early date.

There is no doubt but that the project depth of 20 inches exists above Greenville to Tarboro. Between Washington and Greenville the project depth of 3 feet exists, but at a new shoal a short distance above Red Banks it is narrow and tortuous. No work has been done on the shoals below Washington, which remain about as in recent years.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1898, balance unexpended		$1,286.73
Amount appropriated by river and harbor act approved March 3, 1899		15,000.00
		16,286.73
June 30, 1899, amount expended during fiscal year		1,395.41
July 1, 1899, balance unexpended		14,891.32
July 1, 1899, outstanding liabilities		219.91
July 1, 1899, balance available		14,671.41
Amount (estimated) required for completion of existing project		29,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$29,500.00	
For maintenance of improvement	3,000.00	
		32,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated for Pamlico and Tar rivers, North Carolina.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838	$10,000	$10,000	August 5, 1886	$5,000	58,000
			August 11, 1888	10,000	68,000
August 14, 1876	15,000	15,000	September 19, 1890	10,000	78,000
May 3, 1879	6,000	21,000	July 13, 1892	10,000	88,000
June 14, 1880	9,000	30,000	August 18, 1894	10,000	98,000
March 3, 1881	8,000	38,000	June 3, 1896	5,000	103,000
August 2, 1882	10,000	48,000	March 3, 1899	15,000	118,000
July 5, 1884	5,000	53,000			

COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	5,299	Oysters	1,730
Cotton seed	5,070	Rosin	72
Cotton-seed meal	352	Turpentine:	
Tobacco, leaf	3	Crude	85
Rice	195	Spirits	18
Grains	2,850	Wood	1,885
Hay	1,175	Timber	140,092
Potatoes	2,460	Lumber	131,884
Vegetables	6½	Shingles	669
Cattle	158	Fertilizers	22,962
Horses	27	Coal and minerals	2,850
Hogs	5	General merchandise	26,336
Poultry	9	Machinery	100
Eggs	48		
Fish	1,834	Total	348,575½
Cotton-seed oil	731		

Number of passengers, 8,960.

Loss since last year, 14,938 tons. Transportation lines established during the year, one.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1875	21,000	1894	119,979
1890	277,832	1895	183,226½
1891	195,600	1896	251,887½
1892	107,097	1897	363,513½
1893	119,505		

Statement of vessels navigating Pamlico and Tar rivers, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers and steam tugs	33	1,559	3 to 9
Barges	43	12,900	6 to 7
Sloops, schooners, etc	50	1,750	2½ to 7½

M 4.

IMPROVEMENT OF CONTENTNIA CREEK, NORTH CAROLINA

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1103.

The operations of the year have been carried on by hired labor and use of United States plant, and have consisted in removing a few snags and other obstructions between the mouth of the creek and Snow Hill.

There have been removed from the channel 41 snags, 2 stumps, 14 trees, and from the banks 4 trees.

This creek is in the second collection district of North Carolina.

Money statement.

July 1, 1898, balance unexpended		$1,174.93
Amount appropriated by river and harbor act approved March 3, 1899		2,000.00
		3,174.93
June 30, 1899, amount expended during fiscal year		684.95
July 1, 1899, balance unexpended		2,489.98
July 1, 1899, outstanding liabilities		18.48
July 1, 1899, balance available		2,471.50
Amount (estimated) required for completion of existing project		8,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$8,500.00	
For maintenance of improvement	2,000.00	
		10,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$10,000	$10,000	September 19, 1890	$7,000	$52,000
August 2, 1882	10,000	20,000	July 13, 1892	7,000	59,000
July 5, 1884	5,000	25,000	August 18, 1894	10,000	69,000
August 5, 1886	15,000	40,000	March 3, 1899	2,000	71,000
August 11, 1888	5,000	45,000			

COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	625	Fertilizers	1,500
Hay	5	General merchandise	500
Coal	50		
Lumber	20	Total	3,700

Number of passengers, 300.

Gain since last year, 900 tons. Transportation lines established, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	125,225	1894	19,953
1891	55,325	1895	58,018
1892	17,491	1896	16,804½
1893	21,173	1897	2,800

Statement of vessels navigating Contentnia Creek, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.
Steamers	1	76

M 5.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

For previous history and projects see page 1106, Annual Report for 1896.

Project depth of 3 feet exists as far as shoals just below Trenton, in which the depth is 18 inches.

No work has been done during the year.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1898, balance unexpended	$1,287.43
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	3,787.43
June 30, 1899, amount expended during fiscal year	156.47
July 1, 1899, balance unexpended	3,630.96
July 1, 1899, outstanding liabilities	48.36
July 1, 1899, balance available	3,582.60
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1879	$7,000	$7,000	August 11, 1888	$5,000	$50,500
June 14, 1880	10,000	17,000	September 19, 1890	5,000	55,500
March 3, 1881	5,000	22,000	July 13, 1892	5,000	60,500
August 2, 1882	10,000	32,000	August 18, 1894	4,000	64,500
July 5, 1884	10,000	42,000	June 3, 1896	2,000	66,500
August 5, 1886	3,500	45,500	March 3, 1899	2,500	69,000

COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.	Class of goods.	Tons.
Foreign and coastwise:		**Internal:**	
Cotton	5,770	Cotton	1,250
Cotton seed	50	Cotton seed	500
Cotton-seed meal	22½	Cotton-seed meal	40
Tobacco	20	Rice	1
Rice	62	Grains	60
Grains	11,561	Hay	175
Hay	1,285	Potatoes	15
Potatoes	2,651	Vegetables	6
Vegetables	2,200	Cattle	15
Cattle	26	Horses	1½
Horses	107	Poultry	5½
Hogs	7½	Eggs	15
Poultry	20	Oysters	....
Eggs	64	Turpentine:	
Fish	2,832	Crude	....
Oysters	4,334	Spirits	....
Clams	2,082	Wood	625
Rosin	1,740	Timber	25,525
Turpentine:		Lumber	2,400
Crude	78	Shingles	160
Spirits	400	Fertilizers	1,200
Wood	9,375	Machinery	20
Timber	29,250	General merchandise	1,300
Lumber	27,580	Coal	200
Shingles	1,640	Hogs	5
Fertilizers	920	Fish	4
Machinery	54		33,523
Coal and minerals	1,700	SUMMARY.	
General merchandise	22,200		
Tar	71		
Cotton-seed oil	62	Foreign and coastwise	128,164
		Internal	33,523
	128,164	Total	161,687

Number of passengers, 13,400.

Decrease since last year in internal commerce, 1,413½ tons. Increase over last year in foreign and coastwise commerce, 20,311½ tons. Transportation lines established during the year, 1.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1878	22,000	1894	28,055
1890	39,985	1895	142,422½
1891	45,080	1896	142,100½
1892	59,576	1897	142,788½
1893	34,649		

Statement of vessels navigating Trent River, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	24	1,445	2 to 7½
Barges	12	2,500	5 to 7½
Schooners, sloops, etc	125	5,720	2 to 7½

M 6.

IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1109.

During the year no work was done for lack of funds.

The present condition is explained in the following extract from report of Assistant Engineer W. H. Chadbourn, jr., in local charge:

> An inspection in June showed the river up to Kinston to be tolerably clear of snags and trees. Above Kinston there are quite a number of snags and fallen trees, especially in the crooked portion known as "Letalones." The jetties built in recent years are all in fair condition, and, with one or two exceptions, accomplishing the purpose intended. The old jetties are mostly in quite a dilapidated condition, many of them practically all washed up.
>
> The project depth exists up to Village Creek Shoal, 24½ miles. This shoal has 3.5 feet on it. Just above, at a crossing, is only 2.5 feet, and same depth at Wing Dam Crossing and at Maple Cypress. At several other places before the mouth of Contentnia Creek is reached there are slight shoals. The ruling depth to mouth of Contentnia is 2.5 feet at low water. The shoals are short and at crossings. A small amount of new jetty work and dredging will restore the project to mouth of Contentnia, but many old jetties need repairs or other shoals will probably develop.
>
> From mouth of Contentnia to Kinston the ruling depth is 1.5 feet at low water. There are many shoals, mostly crossings.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1898, balance unexpended		$913.12
Amount appropriated by river and harbor act approved March 3, 1899		10,000.00
		10,913.12
June 30, 1899, amount expended during fiscal year		56.98
July 1, 1899, balance unexpended		10,856.14
July 1, 1899, outstanding liabilities		181.41
July 1, 1899, balance available		10,674.73
Amount (estimated) required for completion of existing project		77,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$25,000.00	
For maintenance of improvement	5,000.00	
		30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
June 18, 1878	$40,000	$40,000	August 11, 1888	$15,000	$247,500
March 3, 1879	45,000	85,000	September 30, 1890	20,000	267,500
June 14, 1880	45,000	130,000	July 13, 1892	15,000	282,500
March 3, 1881	30,000	160,000	August 18, 1894	7,000	289,500
August 2, 1882	30,000	190,000	June 3, 1896	7,000	296,500
July 5, 1884	20,000	210,000	March 3, 1899	10,000	306,500
August 5, 1886	22,500	232,500			

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	2,331	Clams	2,082
Cotton seed	5,225	Rosin	68
Cotton-seed meal	312½	Turpentine, crude	126
Tobacco, leaf	59	Turpentine, spirits	400
Rice	1,613	Wood	9,275
Grains	12,561	Timber	85,387
Hay	1,480	Lumber	135,720
Potatoes	9,572	Shingles	10,050
Vegetables	8,951	Fertilizers	18,115
Cattle	258	Machinery	355
Horses	107	General merchandise	27,050
Hogs	20½	Coal and minerals	4,000
Poultry	21½	Tar	57
Eggs	156½	Cotton-seed oil	62
Fish	2,882		
Oysters	4,468	Total	342,815

Number of passengers, 11,550.

Loss over last year, 37.934¼ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1877	75,000	1893	*a* 50,578
1890	328,462	1894	*a* 45,258
1891	267,650	1895	278,025½
1892	253,704	1896	297,092¾

a The statistics for 1893 and 1894 relate entirely to freight carried in bottoms on the river above Newbern. For the preceding years it covered all freight, both above and below Newbern, including rafts.

Statement of vessels navigating Neuse River, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	32	1,445	2 to 7½
Barges	25	6,655	6 to 7½
Schooners, sloops, etc	137	5,000	2 to 7½

M 7.

IMPROVEMENT OF INLAND WATERWAY BETWEEN NEWBERN AND BEAUFORT, NORTH CAROLINA, VIA CLUBFOOT, HARLOWE, AND NEWPORT RIVERS.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1113.

No work was done during the year and the condition of this waterway has not changed.

This waterway is in the collection district of Pamlico and Beaufort, N. C.

Money statement.

July 1, 1898, balance unexpended	$6,785.61
July 1, 1899, balance unexpended	6,785.61
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	57,000.00

Appropriated.

Date.	Amount.	Aggregate.
August 2, 1882	$10,000	$10,000
August 5, 1886	10,000	20,000
August 11, 1888	15,000	35,000

COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	500	Coal and minerals	200
Cotton seed	200	Clams	125
Rice	230	Rosin	100
Grains	700	Turpentine, crude	750
Hay	800	Wood	850
Potatoes	750	Timber	4,500
Vegetables	300	Lumber	4,000
Cattle	60	Shingles	200
Horses	20	Fertilizers	300
Hogs	15	Machinery	100
Poultry	10	General merchandise	5,000
Eggs	30		
Fish	325	Total	20,365
Oysters	300		

Loss over last year, 18,532½ tons. Transportation lines established during the year, none. Passengers, 2,000.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	14,000	1894	Not given.
1891	17,890	1895	29,737
1892	Not given.	1896 (estimated)	29,737
1893	Not given.	1897	38,897½

Statement of vessels navigating waterway between Newbern and Beaufort, N. C., during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	2	65	3.5 to 4	30
Schooners, sloops, etc	45	420	2 to 3.5	765

M 8.

IMPROVEMENT OF HARBOR AT BEAUFORT, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1115.

The work during the year has been by hired labor and use of United States plant, and has been confined to the maintenance of the works previously constructed. At Fort Macon Point 1,666 feet of new sand fences were built, 4,595 feet raised, 23,981 feet filled under, and 3,250 feet repaired. At Shackleford Point 1,403 feet of new sand fences were built, 3,430 feet raised, 17,694 feet filled under, and 2,430 feet repaired.

On Shackleford inner shore low groins of board palings were constructed between high and low water lines to replace those washed up.

The main bar has 10 feet depth at low water, the bulkhead at entrance to bulkhead channel about 4.5 feet at low water, and the dredged channel leading to Beaufort is in as good condition as when dredged.

On both sides of the entrance the beaches have been held intact.

The accompanying map of Beaufort entrance and harbor is from data obtained in connection with surveys for harbor of refuge, Cape Lookout, North Carolina, and shows an interesting phase of the bar channel movement.

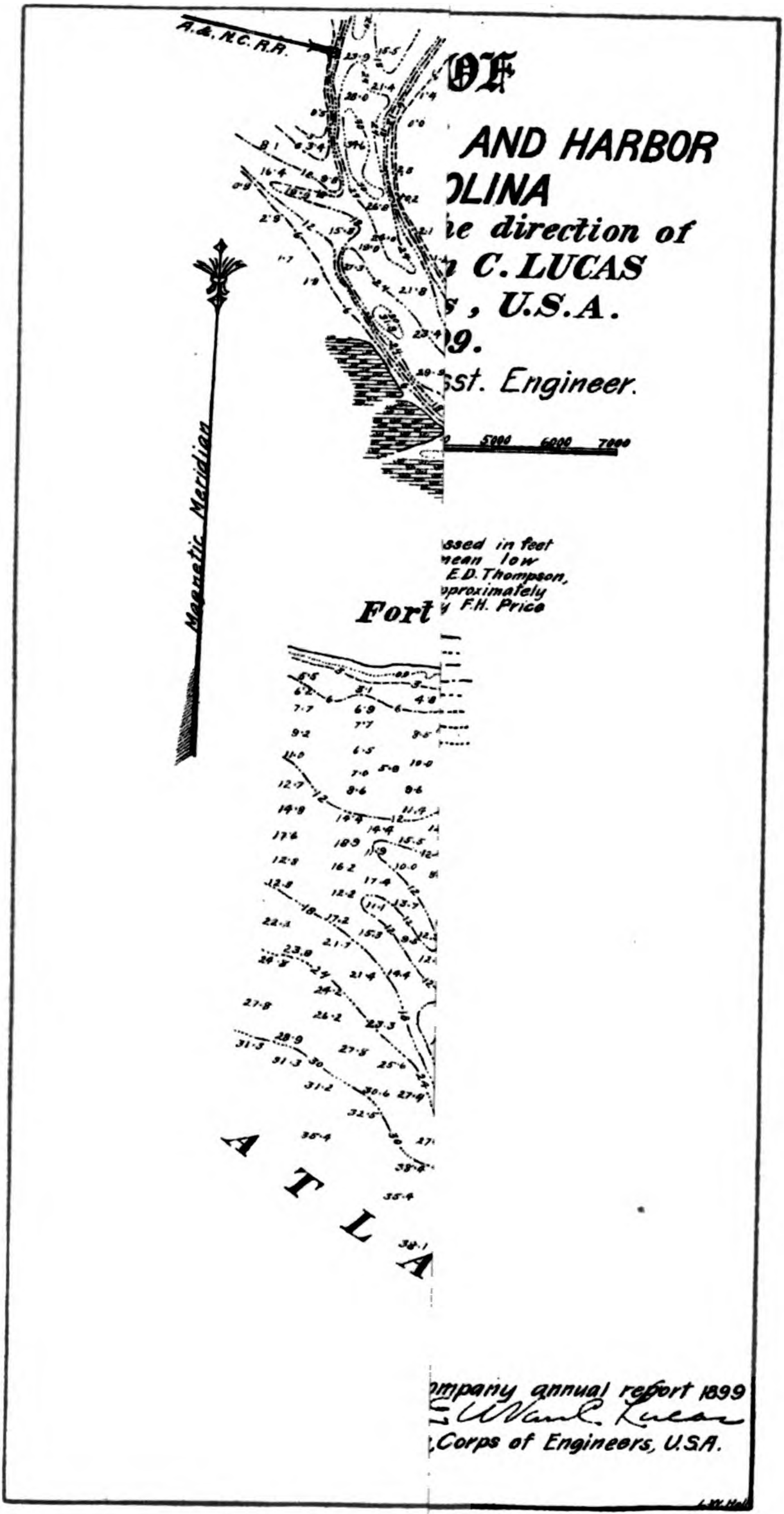
Beaufort is a port of entry.

Money statement.

July 1, 1898, balance unexpended	$4,139.69
June 30, 1899, amount expended during fiscal year	1,287.83
July 1, 1899, balance unexpended	2,851.86
July 1, 1899, outstanding liabilities	103.00
July 1, 1899, balance available	2,748.86

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836	$5,000	$5,000	August 5, 1886	$15,000	$90,000
			August 11, 1888	35,000	125,000
March 3, 1880	30,000	30,000	September 19, 1890	15,000	140,000
August 2, 1882	25,000	55,000	July 13, 1892	10,000	150,000
July 5, 1884	20,000	75,000	June 3, 1896	5,000	155,000



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COMMERCIAL STATISTICS.

Year ending December 31, 1898.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	140	Clams	2,400
Cotton seed	350	Rosin	100
Tobacco, leaf	....	Turpentine, crude	700
Grains	112	Turpentine, spirits	200
Hay	40	Wood	2,800
Potatoes	650	Lumber	7,270
Vegetables	150	Shingles	60
Cattle	45	Fertilizers	1,755
Horses	20	Machinery	2
Hogs	12	Coal and minerals	4,000
Poultry	20	General merchandise	5,050
Eggs	5		
Fish	7,500	Total	38,781
Oysters	8,000		

Number of passengers, 8,000.

Gain over last year, 3,850½ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1880	25,000	1893	62,913
1890	46,675	1894	Not given.
1891	69,330	1895	36,522½
1892	55,070	1896	38,807

Statement of vessels navigating harbor at Beaufort, N. C., during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	10	2,000	5 to 10	150
Schooners and sloops	173	2,095.56	2½ to 10	3,008
Scows	3	9,253	3	45

M 9.

IMPROVEMENT OF INLAND WATERWAY BETWEEN BEAUFORT HARBOR AND NEW RIVER, NORTH CAROLINA.

For detailed description and previous operations see Annual Reports, page 1141 of 1892, page 1397 of 1893, page 1034 of 1894, page 1117 of 1896, and page 1398 of 1897.

This improvement includes 28 miles of channel from Beaufort to Swansboro, almost entirely in Bogue Sound, and 22 miles of channel from Swansboro to New River, through narrow tidal channels varying from 1,000 to 12 feet in width and 10 feet to 6 inches in depth.

The project of 1885, as amended in 1896, is "to obtain a channel 60 feet wide and 3 feet deep at mean low water through Bogue Sound." No work has been done on this improvement since November, 1896, at which date the project depth and width had been obtained, excepting for a distance of approximately 8,000 feet, where the channel width is but 40 feet, the depth being 3 feet or more.

Work has since been suspended because the last appropriation of $1,000 is too small for advantageous application.

This improvement is a part of the inland waterway south of the Chesapeake Bay and will eventually be of far greater importance than at present.

The commercial statistics for 1898 show a gain in freight of about 12 per cent and a gain in passengers of about 50 per cent over the previous year.

Money statement.

July 1, 1898, balance unexpended		$1,000.00
July 1, 1899, balance unexpended		1,000.00
Amount (estimated) required for completion of existing project		6,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$6,500.00	
For maintenance of improvement	2,000.00	
		8,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$10,000	$10,000	July 13, 1892	$10,000	$40,000
August 11, 1888	5,000	15,000	August 18, 1894	2,500	42,500
September 19, 1890	15,000	30,000	June 3, 1896	1,000	43,500

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	400	Oysters	4,200
Cotton seed	26	Clams	1,100
Cotton-seed meal	10	Rosin	900
Rice	12	Turpentine, crude	405
Grains	110	Turpentine, spirits	160
Hay	160	Wood	3,000
Potatoes	55	Lumber	6,000
Cattle	122	Shingles	1
Horses	45	Fertilizers	1,500
Hogs	55	General merchandise	1,200
Poultry	5⅛		
Eggs	2	Total	21,968⅛
Fish	2,500		

Number of passengers, 1,500.

Increase since last year, 2,774¾ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1886	12,250	1894	Not given.
1890	29,332	1895	21,874
1891	30,240	1896	18,022
1893	32,638	1897	19,193⅜

Statement of vessels navigating waterway between Beaufort Harbor and New River, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	2	76.16	4	30
Schooners, sloops, etc	30	1,850	3 to 9	600
Scows	3	92.53	4	160

M 10.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

For description of river and previous operations, see Annual Reports, page 1149 of 1892, page 1400 of 1893, page 1037 of 1894, page 1328 of 1895, and page 1120 of 1896.

The condition of this improvement on June 30, 1896, was then reported as excellent, the project depth having been secured from ocean to the upper river at all points, excepting over the shoal at the upper end of Wrights Island Cut. The depth on this shoal has since increased to more than the project depth.

The solution of the engineering problem here presented was apparently found in the construction, in 1894–95, of a training dike 1,495 feet long in the channel around Cedar Bush Marsh, the effect of which was reported in 1896 as having resulted in the formation of a channel "nearly 5 feet deep in the vicinity of the dike where formerly were two troublesome shoals."

This training dike was built of sheet piles, and in the 1895 report occurs the statement: "The training dike of sheet piles will doubtless be destroyed by the teredo in a few years, when it can be replaced by the same material, or more expensively of stone, at an estimated cost of $5,000, or not at all, as may be found expedient." Since 1896 no work has been done on the training wall, and, as predicted, it has almost entirely disappeared, with the result that "the splendid channel, nearly 5 feet deep," has deteriorated to a very poor one about 18 inches deep. The best channel passes through a gap in the training wall near the upper end, then back of the training wall through an old slough and out through the wall near its root. Through this circuitous channel a draft of about 3 feet can be carried.

Asst. Engineer William H. Chadbourn, jr., reports as follows, after an inspection made in June, 1899: "The ocean-going commerce is very small, carried mostly in a few large sharpies and boats of about 15 tons burden, drawing 3½ to 4½ feet of water. These vessel masters and others interested complain bitterly at the apparent abandonment of the improvement, and claim the commerce would increase with a permanent 4-foot channel. For a year or more, while the good channel did exist, there was but little increase of business. * * * The commerce using the upper part of the river under improvement seems much less now than before the work began in 1882."

At the present time the depth on the ocean bar is 3 feet; the depth thence to Cedar Bush Marsh Shoal is 4½ feet, and the depth over this shoal through a circuitous channel is about 3 feet. At this last point the tidal range is a few inches only, so that little or no assistance is afforded by the rising tide.

This river is in the collection district of Beaufort, N. C.

Money statement.

July 1, 1898, balance unexpended		$3,400.00
July 1, 1899, balance unexpended		3,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$7,000.00	
For maintenance of improvement	1,000.00	
		8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838		$50,000	August 5, 1886	$10,000	$20,000
			August 11, 1888	3,000	23,000
August 2, 1882	$5,000	5,000	September 19, 1890	5,000	28,000
July 4, 1884	5,000	10,000	July 13, 1892	5,000	33,000

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1882	5,000	1894	1,147½
1890	17,359	1895	26,771¾
1891	23,838	1896	7,209
1893	1,134½	1897	2,107

Statement of vessels navigating New River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Schooners	4	61	3.6 to 4.5	52

Several small boats, whose tonnage and draft could not be obtained, ply irregularly on the river.

M 11.

IMPROVEMENT OF BLACK RIVER, NORTH CAROLINA

For previous history of this improvement and detailed statements of projects, see Annual Report Chief of Engineers for 1896, page 1125.

Up to May, 1899, for lack of funds no work had been done on this improvement for two years, obstructions had accumulated in the channel, and many complaints from boatmen had been received.

As soon as possible after appropriation of March 3, 1899, became available the snag boat was put in commission and sent to the head of navigation at Clear Run, removing some of the worst obstructions, but work was suspended because of shoal water before the channel could be thoroughly cleared. One hundred and fifty-six miles were run over; 25 snags, 19 trees, and 4 stumps were removed.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1898, balance unexpended	$769.33
Amount appropriated by river and harbor act approved March 3, 1899	2,000.00
	2,769.33
June 30, 1899, amount expended during fiscal year	72.52
July 1, 1899, balance unexpended	2,696.81
July 1, 1899, outstanding liabilities	208.46
July 1, 1899, balance available	2,488.35
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$3,000	$3,000	June 3, 1896	$1,000	$16,000
July 13, 1892	10,000	13,000	March 3, 1899	2,000	18,000
August 17, 1894	2,000	15,000			

Other receipts: March 14, 1897, sale to Cape Fear River, $243.34.

COMMERCIAL STATISTICS FOR THE YEAR ENDING DECEMBER 31, 1898.

	Tons.		Tons.
Cotton	80	Turpentine, spirits	608
Cotton seed	7	Tar	799
Grains	74	Wood	5,000
Hay	7	Timber	15,589
Potatoes	8	Lumber	18
Cattle	84	Shingles	1,563
Horses	12	General merchandise	9,160
Hogs	35	Machinery	12
Poultry	33	Rice	15
Fish	1	Fur and hides	2
Fruit and vegetables	6	Dog's-tongue	6
Fertilizers	307	Peanuts	1
Eggs	10		
Rosin	4,626	Total	38,139
Turpentine, crude	76		

Number of passengers, 675.

Increase since last year 6,995 tons. Transportation lines established during the year, none. All of the above passed over 12 miles of Cape Fear River, North Carolina, above Wilmington, but is not included in the report for that river.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1885	48,650	1894	41,130¼
1890	61,311	1895	63,262
1891	79,429	1896	69,033½
1892	56,051	1897	31,144
1893	45,003		

Statement of vessels navigating Black River, North Carolina, during the calendar year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	4	180.72	3 to 3.5
Steam tugs	5	105.86	3.5 to 4.5
Flats	[a] 38	2,750	1.5 to 4

[a] About.

M 12.

IMPROVEMENT OF NORTH EAST (CAPE FEAR) RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of the Chief of Engineers for 1896, page 1122, and for 1897, page 1400.

No snagging during the year, for want of funds. Plant has been cared for.

The work has been under the local charge of Supt. Charles Schuster.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1898, balance unexpended	$566.81
Amount appropriated by river and harbor act approved March 3, 1899	2,000.00
July 1, 1899, balance unexpended	2,566.81
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriated.

September 19, 1890, for North East (Cape Fear) River, N. C	$5,000.00
July 13, 1892, for North East (Cape Fear) River, N. C	5,000.00
August 18, 1894, for North East (Cape Fear) River, N. C	5,000.00
March 3, 1899, for North East River, N. C	2,000.00
Other receipts: March 4, 1897, sales to Cape Fear River	243.33
Total	17,243.33

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1898.

	Tons.		Tons.
Cotton	321	Turpentine, crude	170
Cotton seed	262	Turpentine, spirits	338
Rice	10	Wood	6,500
Grains	300	Timber	13,874
Hay	50	Lumber	87
Potatoes	31	Shingles	313
Peanuts	3	Tar	1,260
Fruits and vegetables	14	Brick	7,500
Cattle	36	Fertilizers	18,988
Hogs	36	General merchandise	3,500
Poultry	30	Lime	500
Eggs	14	Limestone	3,000
Fish	1		
Rosin	2,284	Total	59,422

Decrease since last year, 3,976 tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	40,596	1894	41,096
1891	30,295	1895	39,721
1892	37,429	1896	85,163½
1893	40,388	1897	63,398

Statement of vessels navigating Cape Fear River, North Carolina (North East River), during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	2	92.06	3 to 3.5
Steam tugs	9	178.53	2.5 to 7.5
Steam yachts	2	18.14	4 to 4.5
Flats	a 44	3,300	1.5 to 4

a About.

M 13.

IMPROVEMENT OF CAPE FEAR RIVER ABOVE WILMINGTON, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of the Chief of Engineers for 1896, page 1128.

Little work was done during the year because of the small balance available, and many obstructions accumulated in the channel. After the appropriation of March 3, 1899, became available, the snag boat was put in condition for work, and started snagging on this stream in June, 1899. Work is in progress at close of fiscal year.

To end of year 150 miles were run over and 135 snags, 18 stumps, 31 trees, and 6 logs were removed.

Money statement.

July 1, 1898, balance unexpended		$1,398.82
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		6,398.82
June 30, 1899, amount expended during fiscal year		497.30
July 1, 1899, balance unexpended		5,901.52
July 1, 1899, outstanding liabilities		260.34
July 1, 1899, balance available		5,641.18
Amount (estimated) required for completion of existing project		135,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$25,000.00	
For maintenance of improvement	5,000.00	
		30,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$30,000.00	$30,000.00	August 18, 1894	$14,000.00	$132,250.00
August 2, 1882	30,000.00	60,000.00	June 3, 1896	5,000.00	137,250.00
July 5, 1884	5,000.00	65,000.00	March 3, 1899	5,000.00	142,250.00
August 5, 1886	11,250.00	76,250.00	Other receipts: Sales to other appropriations during 1897		414.33
August 11, 1888	12,000.00	88,250,00			
September 19, 1890	15,000.00	103,250.00			
July 13, 1892	15,000.00	118,250.00			

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1898.

	Tons.
Cotton	1,442
Cotton seed	141
Cotton-seed meal	100
Grains	25
Rice	24
Straw	1,500
Hay	48
Potatoes	32
Fruit and vegetables	18
Cattle	325
Horses	110
Hogs	65
Poultry	20
Eggs	70
Rosin	3,462
Turpentine, crude	180
Turpentine, spirits	669
Tar	3,243
Wood	10,075
Timber	15,989
Lumber	102
Shingles	938
Fertilizer	27,871
Machinery	3
General merchandise	28,950
Coal	2,665
Brick	1,860
Peanuts	10
Fish	6
Total	99,943

Number of passengers, 1,895.

Increase since last year, 8,102 tons. Transportation lines established during the year, none. All of Black River commerce passes over 12 miles of this river, but is not included in the above.

Statement of vessels navigating Cape Fear River, North Carolina, above Wilmington, during the year ending December 31, 1898.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	6	486.60	3.0 to 4.5
Steam tugs	6	114.42	3.0 to 7.5
Steam yachts	2	18.14	4.0 to 4.5

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1880	50,000	1894	85,497
1890	129,000	1895	103,727
1891	88,638	1896	99,357½
1892	72,810	1897	91,841
1893	92,757		

M 14.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

For previous history of this improvement and detailed statements of projects see Annual Report for 1896, page 1131.

The work of the last fiscal year has been carried on by hired labor and use of the United States plant. It has consisted of the work of the suction dredge *Cape Fear* and clam shell dredge *Ajax*, making minor surveys and repairing and watching plant, details of which are given in the accompanying report of Assistant Engineer Charles Humphreys, in local charge.

The pile training wall at Snows Marsh, while gradually deteriorating, has been effective throughout the year in maintaining a good channel across this formerly most troublesome shoal. When the mud bulkheads at the ends of the cut have been removed, probably during the coming winter, this training wall, if maintained, will hold the depth without further dredging. It is a most useful and effective work. Whether or not the upper parts of the training wall will have to be replaced as destroyed by worms, and whether or not the lower part, which the banked sand protects from the worms, will alone prove efficient, are questions that can not yet be determined, but even if the training wall has to be renewed every few years it will be at an expense quite small as compared with that of the constant redredging which had to be resorted to before the training wall was built.

The experience of nearly five years with this training wall seems to indicate that its construction and maintenance costs less than the interest on the cost of a stone training wall, with the further advantage that it can be easily taken out or its position altered if found expedient or desirable. A map showing the condition of this shoal in August last is appended.

The bar channel, after some deterioration due to the absence last summer of the suction dredge at Fernandina, has been again deepened to 20 feet or more, with a least width of 180 feet. It is expected that the full project width of 270 feet can be obtained and maintained during the coming year, but this can only be done by the constant use of the dredging steamer whenever the weather permits. The work of maintaining the project channel depth and width across this bar is about the limit of her capacity.

As noted in the accompanying report of Assistant Engineer Humphreys, the channel at the throat of the inlet has been moving bodily eastward for some years, due to the erosion of Bald Head Point, until the old Woodbury Jetty, which formerly marked the end of Bald Head Point, is now well in the channel, the center of which is approaching it. If very injurious deterioration is to be avoided it appears certain that some method for stopping this erosion at Bald Head Point must be adopted in the near future. For the purpose of making an intelligent study of this question a survey of this part of the river has just been made, a map of which is herewith appended, and a special report on the subject will be submitted as soon as practicable.

The dredged cuts in the river are being maintained fairly well, excepting at Lilliput and Brunswick Cove shoals. The filling in at Lilliput is thought to be due to the ebb current from the west of Big Island, while that at Brunswick Cove is almost certainly due to its position west of the natural line of tidal flow. A series of current observations are contemplated at these localities for the purpose of determining the cause of undue deterioration and ascertaining, if possible, a remedy for it.

A feature of the work on this river has been the notable success of the use of plant owned by the Government. The clam-shell dredge *Ajax*, with tug and scows, was purchased two years ago, and, although laid up for several months last summer, when the tug was needed for submarine-mining work, this plant has done an amount of dredging which, at the average contract price since 1890 of 13.1 cents per yard, would have cost $177,139.72. During the same time the total expenditures for purchase, maintenance, running expenses, etc., has been $134,789.25, so that the plant has paid for and maintained itself and earned $42,350.48 in addition. Considering as assets the supplies on hand at the end of the fiscal year, the excess earnings amounted to nearly $50,000. The financial history of this plant is shown graphically by the accompanying chart.

This work has been in charge of Asst. Engineer Charles Humphreys, and under his effective management is becoming a model of its kind.

Wilmington is a port of entry.

Money statement.

July 1, 1898, balance unexpended		$102,088.89
Amount appropriated by river and harbor act approved March 3, 1899		150,000.00
October 1, 1898, received from Navy Department for coal	$21.37	
March 6, 1899, received from Cumberland Sound for rent	3,697.03	
		3,718.40
		255,807.29
June 30, 1899, amount expended during fiscal year		67,580.70
July 1, 1899, balance unexpended		188,226.59
July 1, 1899, outstanding liabilities		3,091.90
July 1, 1899, balance available		185,134.69
Amount (estimated) required for completion of existing project		885,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$250,000.00	
For maintenance of improvement	35,000.00	
		285,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 2, 1839, to July 22, 1854		a $363,228.92	August 2, 1882	$225,000	$1,502,500.00
			July 5, 1884	200,000	1,702,500.00
July 11, 1870	$100,000	100,000.00	August 5, 1886	157,500	1,860,000.00
March 3, 1871	75,000	175,000.00	August 11, 1888	245,000	2,105,000.00
June 10, 1872	100,000	275,000.00	September 19, 1890	170,000	2,275,000.00
March 3, 1873	100,000	375,000.00	July 13, 1892	200,000	2,475,000.00
June 23, 1874	150,000	525,000.00	August 18, 1894	200,000	2,675,000.00
March 3, 1875	150,000	675,000.00	June 3, 1896	195,000	2,870,000.00
August 14, 1876	132,500	807,500.00	March 3, 1899	150,000	3,020,000.00
June 18, 1878	160,000	967,500.00	Other receipts: Sales and rents to other appropriations.	1,024.56 3,718.40	4,742.96
March 3, 1879	100,000	1,067,500.00			
June 14, 1880	70,000	1,187,500.00			
March 3, 1881	140,000	1,277,500.00			

a Balance of $3,728.07 turned over to surplus fund.

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1898.

Exports, foreign and coastwise.

[Furnished by Col. J. L. Cantwell, secretary of the Wilmington Produce Exchange.]

	Tons.
Cotton	85,130
Lumber	45,108
Shingles	4,289
Rosin	24,633
Tar	6,763
Turpentine, spirits	5,101
Turpentine, crude	251
Pitch	220
Miscellaneous (estimated)	60,000
Total	231,495

Exports, internal.

[Furnished by steamboat, flat, and raft men.]

Miscellaneous	91,642
Total of exports, foreign, coastwise, and internal	323,137

Imports, foreign and coastwise.

[Furnished by importers and manufacturers.]

	Tons.
Fertilizer	58,516
Coal	18,187
Salt	7,503
Oil	13,097
Rice	1,597
Miscellaneous (naval stores, cotton and general merchandise)	100,000
Total	198,900

Imports, internal.

[Furnished by steamboat, flat, and raft men.]

	Tons.
Cotton	1,843
Tar	5,302
Turpentine, spirits	1,615
Turpentine, crude	426
Rosin	10,372
Lumber and timber	45,470
Shingles	2,814
Wood	21,575
Miscellaneous	16,445
Total	105,862
Total of imports, foreign, coastwise, and internal	304,762

Summary.

	Tons.
Exports:	
Foreign and coastwise	231,495
Internal	91,642
Imports:	
Foreign and coastwise	198,900
Internal	105,862
Total	627,899

Increase since last year, 32,473 tons.

One transportation line was established during the year.

Foreign commerce for the year 1898.

[Furnished by Mr. J. C. Dancy, collector of customs.]

Class of goods.	Quantity.	Value.	
		Exports.	Imports.
Cotton ......bales..	318,450	$8,991,636	....
Rosin ......barrels..	144,368	196,637	....
Tar ......do....	14,470	28,464	....
Turpentine and pitch ......do....	1,362	2,377	....
Turpentine, spirits ......gallons..	287,912	88,428	....
Lumber ......M feet..	7,552	94,399	....
Shingles ......M..	2,290	11,519	....
Pig iron ......tons..	900	22,500	....
Miscellaneous	....	2,499	$140,195.75
Total	....	9,438,459	140,195.75

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1869	220,000	1893	392,965
1889	325,512	1894	437,623
1890	346,557	1895	618,054
1891	344,743	1896	573,208
1892	341,468	1897	595,426

Cotton steamers loaded at the port of Wilmington, N. C., during the calendar year ending December 31, 1898.

[Furnished by Messrs. A. Sprunt & Son and Mr. J. H. Sloan.]

Name of steamer.	Registered tonnage.	Draft, loaded.		Bales.
		Ft.	*In.*	
Loaded by A. Sprunt & Son:				
Yearby	1,664	15	3	9,000
Hawkhurst	1,537	16	9	8,063
Morven	2,360	19	0	12,388
Lucina	1,689	17	6	8,172
Schiehallion	1,041	18	0	8,867
Cambay	1,693	17	6	8,867
Yearby	1,664	15	0	9,133
Titanic	1,024	16	0	4,400
Yearby	1,664	15	6	9,564
Moorby	1,673	15	6	9,240
Hawkhurst	1,587	17	0	8,535
Knutsford	1,352	18	0	7,340
Tenby	2,559	19	0	14,642
Bellerby	1,979	18	0	10,850
Beltisloe	1,851	19	0	10,182
Aurora	1,835	17	6	9,883
Dorset	1,636	19	0	8,045
Avery Hill	2,020	18	0	10,095
Venus	2,312	17	6	11,741
Eskdale	1,926	19	0	9,706
Preston	1,327	17	3	6,839
Nordkyn	2,104	18	0	11,044
Wilderspool	1,804	16	6	9,720
Gellivera	1,617	14	6	7,305
Naranja	658	16	0	2,947
Chatburn	1,225	16	0	6,002
Hurworth	1,520	16	10	7,702
Titanic	1,024	17	0	4,781
Kassala	2,498	18	7	14,495
Buckingham	1,876	18	6	9,514
Karoon	1,343	17	6	6,764
Loaded by J. H. Sloan:				
Evandale	2,468	20	6	12,720
Acacia	1,538	15	6	8,150
Amaranth	1,710	19	0	8,948
Hindoustan	1,850	20	6	9,042
Total	59,578	....		309,136

Statement of vessels of 100 tons and over at the port of Wilmington, N. C., for the calendar year ending December 31, 1898.

[Furnished by Capt. Edgar Williams, harbor master.]

Class of vessel.	American.		Foreign.		Total.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steamers	96	98,785	41	65,473	137	164,258
Barks	....	....	30	16,550	30	16,550
Brigs	4	1,238	1	198	5	1,436
Barges	15	12,843	....	....	15	12,843
Schooners	96	81,439	13	2,596	109	34,035
Total	211	144,306	85	84,817	296	229,122

The above does not include vessels which took cargoes to Southport, vessels coming to Southport in distress, for supplies, or for a harbor, the total estimated tonnage of which is 15,000, or vessels and barges taking cargoes to Fort Caswell, the total estimated tonnage of which is 65,000.

Vessels owned by the United States Government are not included. No record is made of steamboats plying on the rivers above Wilmington or of small vessels of less than 100 tons.

Statement of vessels plying on the Cape Fear River, North Carolina, at and below Wilmington, during the calendar year ending December 31, 1898.

[This statement is in addition to that furnished by Capt. Edgar Williams.]

Class of vessel.	Number.	Aggregate net tonnage.	Draft.
Steamers	14	5,378.07	2.5 to 16
Steam tugs	14	384.65	2.5 to 10
Steam yachts	2	18.14	4 to 4.5

REPORT OF MR. CHARLES HUMPHREYS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., June 30, 1899.

CAPTAIN: I have the honor to submit the following report of operations for the improvement of Cape Fear River, North Carolina, at and below Wilmington, for the fiscal year ending June 30, 1899.

To July 1, 1898, dredging had been done at the various shoals as follows. The depths refer to mean low water.

Name of shoal.	Distance below Wilmington.	Length.	Width.	Depth.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Feet.*	
Wilmington	0	8,200	270	20	
Alligator Creek	1½	9,800	148	20	
Brunswick River	3	8,600	222 to 148	18 to 20	Upper 5,800 feet 222 feet wide, 18 feet deep; lower 2,800 feet 148 feet wide, 18 feet deep; 8,600 feet 74 feet wide and 20 feet deep.
Logs and Big Island	7	10,400	148	18	
Keg Island	9½	2,200	148	18	
Lilliput	11	13,100	148	18 to 20	Lower reach is 148 feet wide, 20 feet deep; of the upper reach 6,100 feet is 111 feet wide, 20 feet deep, and 4,100 feet is 74 feet wide and 20 feet deep; balance 18 feet deep.
Old Brunswick Cove	13½	5,000	148	20	Balance of 270 feet, width 18 feet deep.
Midnight	16	14,500	148	18 to 20	Upper reach 74 foot wide, 20 feet deep; lower reach, 37 feet wide, 20 feet deep; balance 18 feet deep; 2,400 feet of 18-foot channel, at angle, 209 feet wide.
Reaves Point	19	2,000	148 to 185	18	Upper 900 feet is 185 feet wide; lower 1,100 feet is 148 feet wide.
Snows Marsh	20	9,600	233 to 270	16 to 18	18-foot channel 110 feet wide; balance 16 feet to 18 feet deep.
Ocean Bar	25	6,000	100 to 270	20 to 18	20-foot channel deteriorated during absence of dredge Cape Fear.

These channels had been previously dredged to 16 feet depth for the full width of 270 feet, excepting Snows Marsh Channel, where the bottom width was 233 feet, and Keg Island Shoal, where the natural depth exceeded 16 feet.

New Inlet and Swash Defense dams were in a good and substantial condition. The dike at Snows Marsh had been built for a length of 9,964 feet, 7,743 feet of which was built of piles and brush, and the remaining 2,221 feet of a single row of closely driven piles; the pile and brush portion had been several times repaired by filling in with brush, and 2,470 feet had been repaired by a single row of closely driven piles; the portion built of close piles and the part repaired with them was in fair condition, and the pile and brush portion in bad condition.

The operations for the year have principally consisted of the work of the suction dredge *Cape Fear* and clam-shell dredge *Ajax*, making minor surveys and repairing and watching plant. All work was done by hired labor and United States plant.

The suction dredge *Cape Fear* returned from Fernandina July 23, and resumed work July 26 and continued on the outer bar when weather permitted, and at other times at Snows Marsh and Reaves Point, the shoals nearest the mouth of the river, to January; since then, on the bar and shoal on west edge of channel opposite Old Baldhead Jetty.

The amount of work done by the boat during the year and location of the same is as follows:

	Cubic yards.
Ocean Bar and shoal opposite Old Baldhead Jetty	278,344.1
Snows Marsh Channel	55,295.0
Reaves Point Shoal	14,522.0
Total	348,161.1

The cost of the same may be summarized as follows:

Items.	On hand June 30, 1898.	Purchased during fiscal year.	On hand June 30, 1899.	Used during fiscal year.
Labor		$8,707.00		$8,707.00
Fuel	$885.00	4,379.11	$2,116.93	3,147.18
Easton, towing fuel		296.85		296.85
Supplies		260.94	75.00	185.94
Repairs and property		4,854.15	2,500.00	2,354.15
Subsistence		1,500.95		1,500.95
Repairing Southport wharf		488.22		488.22
Watching Wilmington yard		210.00		210.00
Yard rent at Wilmington		90.00		90.00

Total cost		$16,980.29
Deduct as follows:		
Received from Fernandina bar improvement	$3,697.03	
Received from Fort Caswell for fuel used	143.15	
Received from Navy Department for fuel used	21.37	
		3,861.55
Total cost of operating		13,118.74
Other expenses chargeable to the work:		
Surveys	$1,626.98	
Surveys, use of steamer *Easton* (part)	2,104.07	
Superintendence	1,737.74	
Superintendence, use of steamer *Easton* (part)	523.01	
		5,991.80
Total cost of operating, superintending, and surveying		19,110.54

	Cents.
Cost per cubic yard for operating	3¾ +
Cost per cubic yard for operating, superintending, and surveying	5½ —

This dredging cost much less per cubic yard this year than last, principally due to the fact that the supplies, etc., used by Fernandina improvement were charged in last year's cost and when paid for were credited to this year's cost.

The clam-shell dredge *Ajax* completed repairs and resumed work on October 8, and has since been continually at work.

The amount of work done by the dredge and location of the same is as follows:

Name of shoal.	Cubic yards.	Stumps.	Logs.
Lilliput Shoal	89,039.0	3	......
Keg Island Shoal	54,441.0	19	......
Midnight Shoal	263,136.0	14	3
Reaves Point Shoal	113,880.0	......	1
Logs and Big Island Shoal	68,158.4	39	5
Total	588,604.4	75	9

The cost of the same may be summarized as follows:

Operating dredge and scows.

Items.	On hand June 30, 1898.	Purchased during fiscal year.	On hand June 30, 1899.	Used during fiscal year.
Labor	......	$6,327.33	......	$6,327.33
Repairs	......	11,604.82	$2,800.00	8,804.82
Supplies	......	637.06	400.00	237.06
Fuel	$2,609.03	3,338.47	4,144.41	1,803.09
Subsistence	......	1,297.90	......	1,297.90
Yard rent	......	270.00	......	270.00
Watching yard	......	630.00	......	630.00

Total cost of operating dredge and scows		$19,370.20
Operating steamer *Cynthia*:		
Labor	$3,285.00	
Repairs	6,505.67	
Supplies	94.75	
Fuel	877.60	
Subsistence	683.72	
Total cost of operating *Cynthia*		11,446.74
Operating steamer *Easton*, part chargeable to *Ajax* dredging		2,738.15
Total cost of operating dredge, tugs, and scows		33,555.09
Other expenses chargeable to the work:		
Superintendence and surveys	$2,592.44	
Superintendence, use of steamer *Easton* (part)	820.02	
		3,412.46
Total cost of operating, superintending, and surveying		36,967.55
		Cents.
Cost per cubic yard for operating, excluding stumps and logs		$5\frac{7}{10}+$
Cost per cubic yard for operating, superintending, and surveying		$6\frac{3}{10}-$

There was charged to the main office for use of steamer *Easton*, during the year, $690.22, which amount is not included in the cost of work.

Detailed statement of cost of operating steamer *Easton*:

Labor	$3,586.51
Repairs	1,737.36
Supplies	104.80
Fuel	811.01
Subsistence	932.64
Total cost of operating *Easton*	7,172.32

This amount has been charged as follows:

Towing fuel to Cape Fear	$296.85
Superintending Cape Fear's work	523.01
Surveying Cape Fear's work	2,104.07
Towing mud, etc., for *Ajax*	2,738.15
Superintending and surveying *Ajax's* work	820.02
Main office use	690.22
Total	7,172.32

Summary of expenditures.

Operating dredge *Cape Fear*, with other expenses	$19,110.54	
Operating dredge *Ajax*, with other expenses	36,967.55	
Expenses chargeable to main office	690.22	
Cost of work done during the year		$56,768.31
Add material on hand July 1, 1899	$12,036.34	
Add amount paid by Fernandina improvement	3,697.03	
Add amount paid by Fort Caswell	143.15	
Add amount paid by Navy Department	21.37	
		15,897.89
Total		72,666.20
Less amount on hand July 1, 1898		3,494.03
Expenditures for the year		69,172.17

In making up the cost of the work the expenditures of your office are not included.

PRESENT CONDITION OF WORK.

At the Ocean Bar there is a straight 20-foot mean low-water channel from deep water inside to deep water outside, with a least width of 180 feet. After working eleven months at a cost of $19,110.54 the bar is in about the same condition as before the boat left for Fernandina, Fla.

At Snows Marsh Channel the 18-foot mean low-water channel was 150 feet wide at the narrowest point when the last survey was made.

At Reaves Point Shoal a 20-foot mean low-water channel has been dug 148 feet wide for the whole length.

At Midnight Shoal the 20-foot mean low-water channel has been increased in width to 148 feet for the entire length.

At Lilliput Shoal the 20-foot mean low-water channel has been increased in width to 148 feet for the entire length.

At Keg Island Shoal a 20-foot mean low-water channel has been dug 148 feet wide for the entire length.

At Logs and Big Island Shoal a cut 37 feet wide and 20 feet deep at mean low water has been dug for a length of 8,000 feet.

Other dredged channels in the river are supposed to be in about the same condition as at the beginning of the year. The shore lines of Federal Point, Zeeks Island, and the long line of beaches extending from Zeeks Island to Smiths or Baldhead Island, Baldhead Point, and Oak Island remain in about the same condition as at the report of last year.

Opposite Baldhead Jetty the channel has been moving bodily to the eastward for many years, until the jetty is surrounded by deep water and may become an obstruction to navigation; there is also danger of the channel cutting across to the westward.

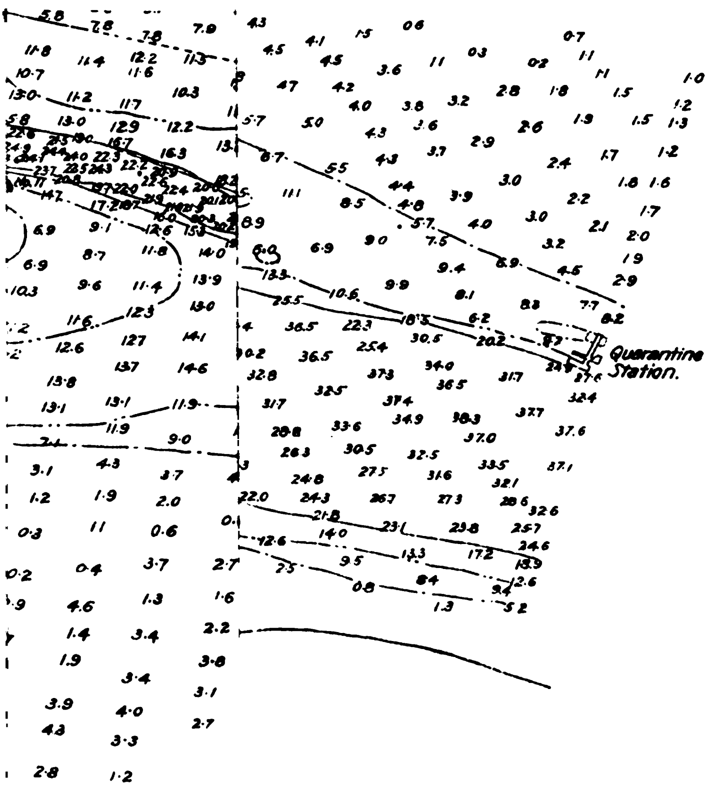
The solid pile portion of Snows Marsh Dike is in fair condition, but needs repairs; the pile-and-brush portion has been nearly destroyed by sea and worms. New Inlet and Swash Defense dams are in good and substantial condition.

Surveys were made during the year as follows:

	Square miles.	Soundings.
August 6, 1898, Ocean Bar Channel	0.5	1,325
August, 1898, to January, 1899, Ocean Bar	8	4,175
December 16, 1898, Ocean Bar Channel	.3	623
January 21, 1899, Ocean Bar Channel	.3	940
February 28, 1899, Ocean Bar Channel	.1	127
May and June, 1899, Ocean Bar	14	11,543
July–August, 1898, Snows Marsh and vicinity	7	5,798
November 23, 1898, Reaves Point Channel	.3	492
January 9, 1899, Keg Island Channel	.3	457
Total	25.8	25,480

Soundings were taken on ranges and located by intersection with one transit angle from the shore.

A map of the last survey of the river in the vicinity of Snows Marsh Channel and a map of the entire Ocean Bar with Caswell and Baldhead Point beaches are submitted herewith.



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Engineers, U.S.A.

. PHOTO.-LITHO. BALTIMORE

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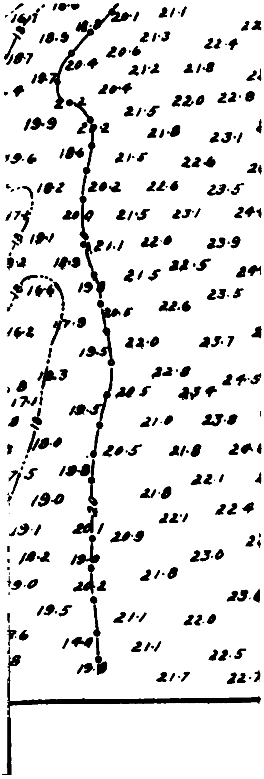

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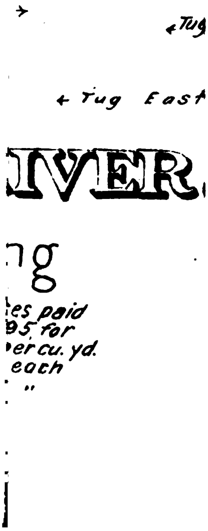
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NOTES.

The suction dredge *Cape Fear* has removed from Cape Fear River since built and delivered, June 8, 1895, 1,555,834 cubic yards of material, the total cost of which has been as follows:

Boat delivered at Southport, N. C	$60,809.30
Coal dock built at Southport, N. C	4,480.64
Operating, June 8, 1895, to June 30, 1899	69,246.57
Total for plant and operating	134,536.51
Superintendence, surveys, and ranges	15,729.36
Total for plant, operating, superintending, and surveying	150,265.87

	Cents.
Cost per cubic yard for operating	$4\frac{5}{10}-$
Cost per cubic yard for plant and operating	$8\frac{6}{10}+$
Cost per cubic yard for plant, operating, superintending, and surveying	$9\frac{6}{10}+$

The clam-shell dredge *Ajax* has removed from the river since purchased, January, 1897, 1,296,315 cubic yards of material, 212 stumps, and 14 logs, the total cost of which has been as follows:

First cost of dredge, tug, and scows	$39,550.00
Operating since purchased to date	87,894.84
Total for plant and operating	127,444.84
Superintendence, surveys, and ranges	7,725.45
Total cost of plant, operating, superintending, and surveying	135,170.29

	Cents.
Cost per cubic yard, excluding logs and stumps, for operating	6.8—
Cost per cubic yard, excluding logs and stumps, for plant and operating	9.8
Cost per cubic yard, excluding logs and stumps, for plant, operating, superintendence, etc	10.4

In making up these costs the expenditures of your office and the part of the *Easton's* expenses charged to your office are not included.

Very respectfully, your obedient servant,

CHAS. HUMPHREYS,
Assistant Engineer.

Capt. E. W. VAN C. LUCAS,
Corps of Engineers.

M 15.

IMPROVEMENT OF TOWN CREEK, BRUNSWICK COUNTY, NORTH CAROLINA.

For previous operations and detailed descriptions see Annual Reports, page 1023 of 1881, 862 of 1883, and 1434 of 1897.

The appropriation of $1,000, made in 1881, was expended in the partial completion of a project "for removing logs, snags, and other obstructions from the channel, and dredging a channel 4 feet deep and 60 feet wide through three shoals just below Russells Landing." The limited amount of this appropriation was sufficient only to clear away the worst obstructions and to increase the depth on the shoals named to 3½ feet at ordinary high water. No work has been done since 1883.

The river and harbor act of 1896 ordered an examination of this stream, which resulted in the recommendation of the district engineer "to make a channel 40 feet wide at bottom and 5 feet deep at mean low water from the mouth to Upper Bridge, and to snag and remove obstructions from the creek from the mouth to the Rocks: *Provided*, That no work be done until Upper Bridge is provided with a proper draw, at an estimated cost of $8,500," which sum was appropriated under the act of March 3, 1899, for that work.

The Secretary of War has approved the county commissioners' plan for proposed draw in Upper Bridge, and as soon as work thereon is completed it is proposed to begin work of improvement so as to complete it, if practicable, by the next harvest season.

The proposed improvement is to dredge through a shoal 1,600 feet long at the mouth of the creek, and through shoals just below Upper Bridge, aggregating 1,500 feet in length, and to clear the creek of obstructions from its mouth to Rocks Landing, about 24 miles above. The obstructing shoals below Upper Bridge are apparently the same on which dredging was done under the previous appropriation of 1881.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$8,500.00
July 1, 1899, balance unexpended	8,500.00

M 16.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of a sunken scow in Pamlico River at Washington, N. C.—The work of removing this wreck was assigned to my predecessor, Capt. W. E. Craighill, Corps of Engineers, by letter from office of the Chief of Engineers, United States Army, November 11, 1898 (28858), and an allotment of $75 made therefor.

The wreck was completely removed on December 1, 1898, at a total cost of $70.15, and the unexpended balance of the allotment, $4.85, was refunded on January 25, 1899.

APPENDIX N.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

REPORT OF MAJOR E. H. RUFFNER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Waccamaw River, North Carolina and South Carolina.
2. Little Pedee River, South Carolina.
3. Great Pedee River, South Carolina.
4. Georgetown Harbor, South Carolina.
5. Winyah Bay, South Carolina.
6. Santee River, South Carolina.
7. Wateree River, South Carolina.
8. Congaree River, South Carolina.
9. Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby.
10. Harbor at Charleston, South Carolina.
11. Wappoo Cut, South Carolina.
12. Beaufort River, South Carolina.
13. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEY.

14. Entrance to Charleston Harbor, South Carolina.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., July 19, 1899.

GENERAL: There are inclosed herewith my annual reports for the fiscal year ending June 30, 1899, for the works of improvement of rivers and harbors which have been in my charge.

Very respectfully,

E. H. RUFFNER,
Major of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

N 1.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 848, Annual Report for 1880. For map of river see page 1200, Annual Report for 1889.

WORK OF PAST YEAR.

Owing to the continued high water, work could not be done to advantage till April 21, 1899. After that time a snag boat was worked over the stream from its mouth to a point 117 miles above, removing from the channel 294 logs, 101 stumps, and 226 large snags. From the banks 217 overhanging trees were cut. Of the total amount expended 7½ tenths were used on the channel and 2½ tenths on the banks. The removal of each obstruction cost approximately 40 cents.

On account of the small appropriation made March 3, 1899, it will be impossible to do more than maintain the improvement.

REMARKS.

After the project is completed it is estimated that about $6,000 per year will be needed to maintain the channel in a serviceable condition. This river has its outlet into Winyah Bay at Georgetown, forming a part of the Winyah Bay system of rivers, and is of considerable commercial importance. It is deemed well worthy of continued improvement and maintenance after the project has been completed.

No new transportation lines have been established during the year.

The river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1898, none.

Money statement.

July 1, 1898, balance unexpended	$582.31
Amount appropriated by river and harbor act approved March 3, 1899	3,000.00
	3,582.31
June 30, 1899, amount expended during fiscal year	742.20
July 1, 1899, balance unexpended	2,840.11
Amount (estimated) required for completion of existing project	35,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 14, 1880	$15,000
Approved March 3, 1881	10,000
Passed August 2, 1882	4,400
Approved July 5, 1884	6,000
Approved August 5, 1886	15,000
Of August 11, 1888	15,000
Approved September 19, 1890	12,500

By act of Congress—	
Approved July 13, 1892	$10,000
Of August 18, 1894	6,000
Of June 3, 1896	6,000
Approved March 3, 1899	3,000
Total	102,900

Total expenditures, including June 30, 1899, were $100,059.89

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ....barrels	76,000	13,300	$228,000	78,000	15,600	$156,000
Tar ....do	557	56	1,114	407	81	814
Spirits of turpentine ....do	12,000	2,250	240,000	14,000	2,800	220,000
Turpentine, crude ....do	6,000	840	15,000	4,000	600	8.000
Cotton ....bales	5,500	1,375	275,000	5,000	1,250	175,000
Timber ....sticks	9,547	14,326	40,980	10,640	19,152	53,200
Lumber ....feet	8,800,000	18,333	182,000	9,000,000	15,000	117,000
Shingles	9,800,000	4,900	78,400	9,200,000	4,600	73,600
Rough rice ....bushels	122,000	2,684	152,500	155,100	2,806	178,365
Rice, clean ....barrels	12,000	1,950	195,000	15,508	2,714	271,390
Miscellaneous articles—tallow, eggs, wax, game, poultry, etc	....	1,231	123,118	....	1,500	75,000
Total	....	61,245	1,481,112	....	66,103	1,328,369
INWARD FREIGHTS.						
General merchandise	....	15,000	750,000	....	17,000	850,000
Grand total	....	76,245	2,231,112	....	83,103	2,178,369

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin .... barrels	53,167	10,633	$106,334	72,220	14,444	$144,440
Spirits of turpentine .... do	10,893	2,179	163,395	14,744	2,948	258,020
Crude turpentine .... do	1,330	266	2,660	4,740	948	9,480
Tar .... do	1,238	248	2,476	2,388	477	4,776
Cotton .... bales	17,230	4,307	603,050	5,668	1,417	198,380
Rough rice .... bushels	195,279	4,491	195,279	93,000	2,139	106,950
Rice, clean .... barrels	19,945	3,490	299,175	6,600	1,155	115,500
Rice flour .... bushels	25,000	250	7,500	25,000	250	7,500
Hides .... bales	3	1	200	6	2	400
Wool .... do	5	1	400	34	13	5,100
Clams .... barrels	2,121	424	8,484	3,091	618	12,364
Fish .... do	363	19	95	430	21	2,150
Lumber .... feet B. M.	6,700,000	11,167	100,500	9,158,067	15,263	137,371
Timber .... pieces	10,000	20,000	50,000	37,463	37,463	168,583
Shingles	7,000,000	3,500	56,000	9,244,291	4,622	73,950
Total	....	60,976	1,595,548	....	81,780	1,244,964
INWARD FREIGHTS.						
General merchandise	....	10,000	500,000	....	17,518	875,900
Grand total	....	70,976	2,095,548	....	99,298	2,120,864

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin .... barrels	75,000	13,125	$93,750	74,000	14,800	$185,000
Spirits of turpentine .... do	15,000	2,812	195,000	13,000	3,250	195,000
Crude turpentine .... do	5,130	718	8,978	3,500	700	8,750
Tar .... do	1,000	200	2,000	2,500	875	10,000
Cotton .... bales	9,091	2,273	272,730	8,000	2,000	320,000
Rough rice .... bushels	131,000	2,882	98,250	147,000	3,234	147,000
Rice, clean .... barrels	15,060	2,447	165,660	17,400	2,827	278,400
Rice flour .... bushels	11,255	100	3,000	1,250	13	175
Hides .... bales	4	1	200	25	6	1,250
Wool .... do	60	25	10,000	95	43	2,850
Clams .... barrels	3,091	618	12,364	9,000	1,800	27,000
Fish and caviare .... packages	4,950	200	115,000	5,000	124	150,000
Lumber .... feet B. M.	9,000,000	15,000	150,000	10,000,000	16,666	150,000
Timber .... pieces	63,940	69,055	224,430	65,000	130,000	260,000
Cross-ties	1,338	10	335	....	....	....
Shingles	14,000,000	7,000	112,000	13,000,000	6,500	65,000
Total	....	116,466	1,463,697	....	182,838	1,800,425
INWARD FREIGHTS.						
General merchandise	....	12,000	600,000	....	20,550	513,750
Grand total	....	128,466	2,063,697	....	203,388	2,314,175

Commercial statistics—Continued.

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin........barrels..	78,000	13,600	$175,500	52,000	10,400	$104,000
Spirits of turpentine.......do....	17,500	4,375	262,500	15,000	3,750	225,000
Crude turpentine.........do....	3,000	600	6,750	3,000	600	7,500
Cotton........bales..	8,000	2,000	240,000	10,000	2,500	300,000
Tar........barrels..	3,150	1,102	9,450	2,000	700	6,000
Rough rice........bushels..	150,000	3,300	150,000	217,000	4,774	271,250
Rice, clean........barrels..	15,000	3,000	240,000	21,170	3,440	412,815
Rice flour........bushels..	1,250	18	190	1,700	17	340
Hides........bales..	50	18	2,450	50	18	2,450
Wool........do....	120	48	16,800	120	48	20,175
Fish and vegetables.......cases..	10,500	420	15,750	10,500	420	18,750
Clams and oysters.......barrels..	9,000	1,800	27,000	1,000	200	3,000
Game, etc........packages..	5,000	124	100,000	5,000	124	100,000
Timber........pieces..	75,000	150,000	300,000	85,000	170,000	340,000
Lumber........feet B. M..	10,000,000	25,000	150,000	10,000,000	25,000	150,000
Shingles........	15,000,000	7,500	75,000	15,000,000	7,500	75,000
Wood........cords..	2,000	2,000	4,000	2,000	2,300	4,000
Cross-ties........	20,000	1,400	6,000	20,000	1,400	6,000
Total........	....	216,300	1,781,390	....	233,191	2,041,280
INWARD FREIGHTS.						
Miscellaneous, fertilizers, etc........	....	25,000	625,000	....	25,000	625,000
Grand total........	....	241,300	2,406,390	....	258,191	2,666,280

The following commercial statistics for 1899 were furnished by Capt. R. G. Dusenbury, master of a freight and passenger steamer belonging to the Waccamaw Line, plying on the river daily:

Articles.	No.	Tons.	Value.
OUTWARD FREIGHTS.			
Rosin........barrels..	75,000	15,000	$187,500
Cotton........bales..	12,500	3,125	375,000
Rough rice........bushels..	235,000	5,170	288,750
Clean rice........barrels..	26,000	4,225	422,500
Rice flour........bushels..	2,000	20	400
Tar........barrels..	4,000	1,400	15,000
Hides........bales..	50	20	3,000
Wool........do....	150	60	24,000
Fish and vegetables........packages..	15,000	600	25,000
Shellfish........barrels..	10,000	1,500	25,000
Game, etc........packages..	5,000	124	100,000
Timber........pieces..	100,000	200,000	400,000
Lumber........feet..	10,000,000	25,000	150,000
Shingles........	15,000,000	7,500	75,000
Wood........cords..	2,000	2,000	4,000
Ties........	20,000	1,400	6,000
Spirits of turpentine........barrels..	18,000	3,750	360,000
Total........	....	270,894	2,461,150
INWARD FREIGHTS.			
Merchandise, fertilizers, etc........	....	25,000	625,000
Grand total........	....	295,894	3,086,150

This shows an increase of $419,870 in value over last year, and an increase of 37,703 tons.

N 2.

IMPROVEMENT OF LITTLE PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see page 1111, Annual Report for 1887. For map of river, see page 1214, Annual Report for 1890.

WORK OF PAST YEAR.

No work was done on the river during the year.

A small balance remains, which will be held for the purpose of removing any serious obstructions which may appear in the river.

An annual expenditure of $2,000 will be required for the maintenance of this river after the project for improvement is completed.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1897, none.

Money statement.

July 1, 1898, balance unexpended	$313.96
June 30, 1899, amount expended during fiscal year	63.95
July 1, 1899, balance unexpended	250.01
Amount (estimated) required for completion of existing project	28,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Of August 11, 1888	$5,000
Approved September 19, 1890	5,000
Approved July 13, 1892	5,000
Of August 18, 1894	4,000
Of June 3, 1896	3,000
Total	22,000

Total expenditures, including June 30, 1899, $21,749.99.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ... barrels	3,920	686	$5,880	5,000	1,000	$10,000
Spirits of turpentine ... do	408	77	8,160	636	127	9,540
Cotton ... bales	310	78	15,500	600	150	21,000
Ton timber ... sticks	2,200	3,300	9,240	4,240	5,088	15,264
Shingles	30,000	15	240	20,000	10	160
Total	....	4,156	39,020	....	6,375	55,964
INWARD FREIGHTS.						
General merchandise	....	458	13,740	....	740	37,000
Grand total	....	4,614	52,760	....	7,115	92,964

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin..........barrels..	4,400	880	$8,800	5,300	900	$10,600
Spirits of turpentine..........do....	750	150	11,250	800	175	14,000
Cotton..........bales..	700	175	24,500	700	150	24,000
Ton timber..........sticks..	....	....	....	6,000	6,000	18,000
Timber..........do....	4,050	4,050	12,150	....	....	....
Shingles..........	20,000	10	160	....	....	....
Eggs..........crates..	275	4	550	....	....	....
Pease..........bushels..	300	9	375	....	....	....
Cross-ties..........	....	....	....	10,000	250	3,000
Total..........	....	5,278	57,785	....	7,475	69,600
INWARD FREIGHTS.						
General merchandise, fertilizers, etc....	....	875	43,750	....	900	45,000
Grand total..........	....	6,153	101,535	....	8,375	114,600

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin..........barrels..	6,000	1,050	$7,500	5,500	1,100	$11,000
Spirits of turpentine..........do....	940	176	12,220	1,200	300	18,000
Cotton..........bales..	1,250	312	37,500	2,000	500	30,000
Timber..........sticks..	10,000	9,000	29,250	16,000	14,400	64,000
Cross-ties..........	20,000	1,400	6,000	....	....	....
Miscellaneous articles, shingles, staves, etc..........	....	....	....	....	50	1,500
Total..........	....	11,938	92,470	....	16,350	174,500
INWARD FREIGHTS.						
General merchandise, fertilizers, etc....	....	500	25,000	....	150	7,500
Fertilizers..........	....	....	....	....	550	16,500
Grand total..........	....	12,438	117,470	....	17,050	198,500

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton..........bales..	10,500	210	$31,500	1,500	375	$45,000
Rosin..........barrels..	3,200	640	6,400	3,500	700	7,000
Spirits of turpentine..........do....	550	137	8,250	700	150	10,500
Railroad cross-ties..........	50,000	3,500	15,000	....	....	....
Timber..........sticks..	4,000	8,000	16,000	5,000	10,000	20,000
Miscellaneous freights, shingles, staves, etc..........	....	200	10,000	....	200	10,000
Total..........	....	12,687	87,150	....	11,425	92,500
INWARD FREIGHTS.						
Fertilizers..........	....	350	7,000	....	350	7,000
General merchandise..........	....	125	6,250	....	125	6,250
Grand total..........	....	13,162	100,400	....	11,900	105,750

The following commercial statistics for 1899 were furnished by Capt. R. G. Dusenbury, of the Waccamaw Line of steamers, operating boats on this and the adjacent rivers:

Articles.	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	1,750	437	$48,750
Rosin .... barrels..	4,000	800	10,000
Spirits of turpentine .... do....	600	150	12,000
Timber........ sticks..	6,000	12,000	24,000
Lumber, shingles, etc	....	250	12,000
Total	....	13,687	101,750
INWARD FREIGHTS.			
Fertilisers	....	375	7,500
General merchandise........	....	125	6,625
Grand total	....	14,187	115,875

This shows an increase of $10,125 in value over last year, and an increase of 2,237 tons.

N 3.

IMPROVEMENT OF GREAT PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see page 753, Annual Report for 1873. For special description, see page 845, Annual Report for 1880, and page 723, Annual Report for 1879. For map of river, see page 1180, Annual Report for 1889.

WORK OF PAST YEAR.

From July, 1898, until June, 1899, there was an almost continuous freshet in this river, which covered its banks and effectually prevented working to advantage.

During the year 110 trees and 16 cords of brush were cut from the banks; from the channel 107 logs, 45 stumps, and 126 large snags were removed. Of the total amount expended 6½ tenths were used on the channel and 3½ tenths were used on the banks. Each obstruction cost approximately $1.08.

With the small amount appropriated for this work the channel can only be maintained in its present condition; nothing can be done toward the further improvement of the stream.

REMARKS.

This river forms one of the Winyaw Bay system of rivers, and is one of the largest in the State. It has a navigable length of 172 miles. The river is of very decided commercial importance, and is deemed worthy of continued improvement and maintenance by the Government.

A least depth of 3½ feet has been obtained from Cheraw to the Wilmington, Columbia and Augusta Railroad Bridge, a distance of 103 miles, and steamers make regular trips to that point. Beyond the bridge there is a less depth than 3½ feet. To obtain this depth it is estimated that 200,000 cubic yards of material, consisting of sand and pebbles, will have to be removed by dredging. Steamboat navigation beyond the bridge during low-water periods is impossible, and great inconvenience and expense to parties interested has resulted.

After the completion of the project there will be required $8,000 per year for maintenance.

No new transportation lines have been established.

The river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1898, none.

Money statement.

July 1, 1898, balance unexpended	$4,104.67
Amount appropriated by river and harbor act approved March 3, 1899	4,000.00
	8,104.67
June 30, 1899, amount expended during fiscal year	1,530.20
July 1, 1899, balance unexpended	6,574.47
July 1, 1899, outstanding liabilities	336.40
July 1, 1899, balance available	6,238.07
Amount (estimated) required for completion of existing project	5,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	5,500.00

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 14, 1880	$7,000
Approved March 3, 1881	6,000
Passed August 2, 1882	6,000
Approved July 5, 1884	8,000
Approved August 5, 1886	20,000
Of August 11, 1888	20,000
Approved September 19, 1890	12,500
Approved July 13, 1892	$10,000
Of August 18, 1894	6,000
Passed June 3, 1896	12,000
Approved March 3, 1899	4,000
Total	111,500

Total expenditures, including June 30, 1899, $104,925.53.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	5,926	1,483	$296,300	5,780	1,445	$202,300
Clean rice ... barrels	16,342	2,656	265,558	16,560	2,898	289,750
Rough rice ... bushels	83,000	1,827	103,750	88,000	1,524	101,200
Rosin ... barrels	35,800	6,265	50,120	30,000	6,000	60,100
Spirits of turpentine ... do	4,014	652	80,280	5,436	1,087	81,540
Cypres shingles	6,705,987	3,353	53,640	6,970,000	3,485	55,760
Lumber, cypress ... feet B. M	3,000,000	6,250	45,000	3,100,000	5,166	46,500
Cypress logs ... do	22,547	33,821	81,169	...	...	...
Wood ... cords	225	225	563	2,000	2,000	4,000
Hides, wool, staves, etc	...	250	7,500	...	352	17,600
Timber ... sticks	...	...	...	51,640	61,968	216,888
Cross-ties	...	...	...	18,000	144	5,400
Total	...	56,782	983,880	...	86,069	1,080,938
INWARD FREIGHTS.						
General merchandise	...	5,562	383,450	...	6,402	320,100
Grand total	...	62,344	1,367,330	...	92,471	1,401,038

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin....................barrels..	21,345	4,269	$42,690	24,534	4,906	$49,068
Spirits of turpentine.......do....	3,391	678	50,865	7,211	1,442	126,192
Cotton.....................bales..	3,610	903	125,850	6,110	1,027	213,850
Crude turpentine.........barrels..	....	....	....	1,340	268	2,680
Ton timber................sticks..	58,949	58,949	176,847	30,000	60,000	165,000
Shingles............................	9,163,000	4,581	78,304	6,000,000	3,000	36,000
Eggs and poultry.........crates..	275	4	550	....	7	1,000
Pease...................bushels..	300	9	375	....	....	....
Rice, rough..................do....	206,343	4,746	206,343	52,309	1,208	60,155
Lumber................feet B. M..	4,000,000	6,667	60,000	4,000,000	6,667	80,000
Wood.......................cords..	2,800	2,800	5,600	2,800	2,800	5,600
Tar.......................barrels..	850	170	1,700	1,200	240	2,400
Cross-ties..........................	33,000	2,640	9,900	48,750	1,215	14,625
Miscellaneous articles, hides, wool, staves, etc.....................	....	400	20,000	....	450	22,500
Total........................	....	86,816	774,524	....	83,225	779,070
INWARD FREIGHTS.						
General merchandise..............	....	7,845	392,350	....	7,800	390,000
Grand total.................	....	94,661	1,166,874	....	91,025	1,169,070

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin....................barrels..	28,500	4,987	$35,625	20,000	4,000	$40,000
Spirits of turpentine.......do....	6,500	1,219	84,500	7,000	1,750	105,000
Cotton.....................bales..	6,000	1,500	180,000	5,000	1,250	200,000
Crude turpentine.........barrels..	1,260	176	2,205	3,100	620	7,750
Timber....................sticks..	86,000	77,000	250,250	90,000	180,000	360,000
Shingles............................	7,000,000	3,500	56,000	8,000,000	4,000	40,000
Rough rice..............bushels..	85,000	1,870	63,750	99,000	2,178	99,000
Lumber................feet B. M..	5,000,000	8,283	75,000	7,500,000	12,666	112,500
Wood.......................cords..	3,000	3,000	4,500	3,000	3,000	6,000
Cross-ties..........................	50,000	3,500	15,000	....	10,000	40,000
Staves..............................	80,000	80	1,600	....	....	....
Miscellaneous articles............	....	300	90,000	....	500	15,000
Total........................	....	105,415	858,430	....	219,964	1,025,250
INWARD FREIGHTS.						
General merchandise, fertilizers, etc..............................	....	700	35,000	....	10,000	300,000
Grand total.................	....	106,115	893,430	....	229,964	1,325,250

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin....................barrels..	21,425	4,285	$42,850	20,074	4,015	$40,148
Spirits of turpentine.......do....	5,670	1,442	86,565	5,428	1,084	81,345
Crude turpentine............do....	3,800	760	7,600	1,800	202	3,600
Cotton.....................bales..	8,954	1,797	268,620	9,570	2,395	287,100
Tar.......................barrels..	450	90	1,350	1,180	202	2,950
Cross-ties..........................	68,365	4,785	20,509	53,276	3,870	15,982
Shingles............................	10,000,000	5,000	30,000	8,112,000	4,056	40,560
Lumber, cypress........feet B. M..	5,000,000	10,000	90,000	6,000,000	12,000	108,000
Rough rice...............bushels..	90,000	1,980	90,000	98,000	2,156	122,500
Timber, cypress...........sticks..	30,000	60,000	120,000	8,000	16,000	32,000
Wood.......................cords..	550	550	1,100	750	750	1,500
Timber, ash...............sticks..	4,000	8,000	12,000	3,000	6,000	9,000
Timber, pine................do....	2,000	4,000	4,000	8,000	8,000	16,000
Timber, holly...............do....	....	....	....	1,700	850	3,400
Miscellaneous freights, pease, eggs, etc............................	....	167	8,350	....	200	10,000
Total........................	....	102,856	782,944	....	61,780	774,085
INWARD FREIGHTS.						
Fertilizers.........................	....	6,036	120,720	....	7,340	146,800
General merchandise..............	....	5,285	264,250	....	6,160	308,000
Grand total.................	....	114,177	1,167,914	....	75,280	1,228,885

The following commercial statistics for 1899 were furnished by Mr. B. T. Daggett, operating a snag boat on the river, who collected the data in person from farmers, merchants, shippers, steamboat men, and others:

	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	9,976	2,494	$249,400
Rosin .... bbls..	9,800	1,960	24,500
Spirits turpentine .... do....	2,680	670	53,600
Crude turpentine .... do....	1,500	300	3,750
Tar .... do....	875	125	3,500
Cross-ties........	4,700	319	1,410
Shingles........	21,180,500	10,590	63,540
Lumber, cypress .... feet B. M..	18,000,000	36,000	324,000
Timber:			
Cypress .... sticks..	10,000	20,000	40,000
Ash .... do....	2,000	4,000	6,000
Pine .... do....	16,000	16,000	32,000
Holly .... do....	9,000	450	1,800
Wood .... cords..	875	875	1,750
Rough rice .... bushels..	100,000	2,200	125,000
Miscellaneous, chickens, eggs, etc	....	228	11,400
Total........	....	96,221	941,650
INWARD FREIGHTS.			
Fertilizers........	....	3,230	64,600
General merchandise	....	4,783	239,150
Total........	....	104,234	1,245,400

This shows an increase over last year of $16,515 in value and 28,954 tons.

N 4.

IMPROVEMENT OF GEORGETOWN HARBOR, SOUTH CAROLINA.

The project adopted in 1881 was to dredge a channel 12 feet deep at ordinary low water, 200 feet wide, and about 2,850 feet long through a shoal in Winyaw Bay, at the mouth of Sampit River and entrance to Georgetown Harbor.

The estimated cost was $44,500. The work has been completed. During the fiscal year ending June 30, 1899, no money has been spent.

For description of this harbor and previous operations see Annual Reports, 1892, pages 1183, 1184, and of 1893, pages 1437 and 1438.

For this improvement the following appropriations have been made:

By act of Congress of 1882	$7,000
By act of Congress—	
July 5, 1884........	5,000
August 5, 1886	5,000
August 11, 1888	7,500
September 19, 1890........	8,000
July 13, 1892........	12,000
	44,500

Total expenditures to June 30, 1899, $42,980.71.

Money statement.

July 1, 1898, balance unexpended	$1,519.29
July 1, 1899, balance unexpended	1,519.29

N 5.

IMPROVEMENT OF WINYAH BAY, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see page 1164, Annual Report for 1885. For report by Board of Engineers see Annual Report for 1889, page 1114. For description of previous operations see Report for 1894, page 1059; of 1895, page 1349; of 1896, page 1165.

WORK OF PAST YEAR.

Construction of the south jetty, under contract with Mr. R. G. Ross, was continued. There were placed in the work during the year 61,435.31 square yards of mattress, 45,691.59 tons of small stone, and 54,079.06 tons of large stone. This extended the jetty, built to partial dimensions, 4,585 feet, with an apron of mattress and small stone (ballast) 2,811 feet farther. Total length of jetty built during the year, 7,396 feet. Total length of jetty from shore end at South Island, built to partial dimensions, 9,389 linear feet.

The seagoing dredge *Winyah Bay*, built under contract with The Bucyrus Company of South Milwaukee, Wis., was completed during the year, and after passing the required one month's trial commenced active operations in the Bottle Channel September 19, 1898. Since September 19, 1898, she has removed and dumped 172,976.77 cubic yards of material.

The aggregate amounts of material placed in the south jetty up to and including June 30, 1899, are as follows:

Mattress	square yards	71,898.64
Small stone	tons	53,925.02
Large stone	do	55,978.66

A wharf with a coal bin of about 600 tons capacity, and two fresh-water tanks of about 15,000 gallons capacity each, was constructed at North Island, S. C., for use of the dredge.

The accompanying map, showing survey of Bottle Channel, shows an increase of 1 foot in the controlling depth on the bar. Last year there was a least depth of 10 feet at mean low water, and now there is a least depth of 11 feet at mean low water, with 500 feet width at the narrowest point.

The following letters and commercial statistics were furnished by Mr. W. D. Morgan, mayor of Georgetown, S. C.:

MAYOR'S OFFICE, CITY HALL,
Georgetown, S. C., June 19, 1899.

DEAR SIR: At your request I beg to hand you herein statement of the commerce of Georgetown, S. C., and Winyah Bay, South Carolina, for the year 1898.

While some of the items show a falling off as compared with other years, yet the aggregate evidences a decided improvement over the previous two years, and we have every reason to believe that the commerce of the port in the future will show a greater improvement than at any period in its history, which will be due largely to the fact that the ocean entrance to Winyah Bay and Georgetown is being steadily deepened by means of the jetties now being constructed by the Government and the use of the suction dredge on the bar and the assurance of deeper water in the near future.

In addition to the two large sawmills established here last year, each with a daily capacity of 50,000 feet of lumber, we will have in operation by the end of the present year two more large sawmills—the Atlantic Coast Lumber Company, composed of Norfolk and Northern capitalists, and the Tilghman Lumber Company, of Norfolk, Va. Both of these companies have purchased mill sites here, and are preparing to erect extensive plants. They tell me that one of the factors that induced them to locate in Georgetown, in addition to the unequaled supply of timber tributary to the port, is the assurance that we are to have soon deep water on our ocean entrance, offering cheaper means of transportation by a larger class of vessels than have been able heretofore to come here.

All this increase of business only justifies the claims made by us in the past, when we were asking Congress for appropriations for the improvement of our bar, harbor, rivers, and canal. In this connection permit me to call your attention to the necessity of the deepening of Georgetown Harbor from North Island to the head of navigation on the Sampit River, by dredging out all shoal places and removing all obstructions, so that we can have a sufficiently wide and deep channel from the ocean to the city wharves of the same depth as the ocean entrance. This will aid commerce greatly and relieve shipping of all delays in proceeding to the sea, which in these days of close competition is an important factor.

I understand that Congress at its last session provided for a survey of the harbor, with a view of deepening same. I append hereto, and desire that the same be made a part of this letter and report, a letter from Mr. E. B. Freeman, vice-president of the Atlantic Coast Lumber Company, which speaks for itself, and shows what an extensive plant they expect to operate here, all of which is respectfully submitted.

Yours, very truly,

W. D. MORGAN, *Mayor.*

Mr. REID WHITFORD, *United States Assistant Engineer.*

GEORGETOWN, S. C., *June 15, 1899.*

DEAR SIR: In reply to your inquiry regarding our prospective business at this point, we beg to say that about one year ago we visited this city and were induced to buy a large body of timber and timber lands, by reason of the improvements in progress at the outer bar to the harbor.

The timber which we are working is principally short straw or sap pine, and is the lowest in price of any lumber now being sold in the Northern market.

The depth of water on the outer bar has, we have no doubt, been the chief reason why this timber has not been utilized in the past, and it must be handled in large volumes to make it a profitable enterprise, and it can be only so handled by using a much larger class of vessels than has heretofore traded to and from your port.

We contemplate building a modern plant here, consisting of four band mills under one roof, brick dry kilns, and with a capacity of 250,000 to 300,000 feet daily.

To do this we shall have to employ 1,200 to 1,500 men, with a pay roll aggregating $250,000 to $300,000 per annum.

To handle this lumber in the manner above indicated we will require the largest class of coastwise sailing vessels or steamers, or both, and you can readily see that the freight and the output of the proposed mills, namely, 1,600,000 to 2,000,000 feet per week, will require quite a number of vessels drawing from 13 to 18 feet of water, to say nothing of larger vessels for foreign shipments.

Upon investigation we find that while there is now reported 13 feet over the outer bar at low water, there is scarcely 14 feet at high water over the shallows in the inner harbor or bay.

It is therefore all important that this part of your harbor, namely, the inner bars, should have prompt and careful consideration if you are to accommodate the class of shipping that should come to this port to take the business offered.

We know that you are fully alive to the interests of this port, and hope your efforts in this direction will be very fruitful.

We beg to assure you that we stand ready to do all in our power to aid you in the good work.

Very truly, yours,

ATLANTIC COAST LUMBER COMPANY,
By E. B. FREEMAN, *Vice-President.*

Hon. W. D. MORGAN,
Mayor of Georgetown, S. C.

Eng [illegible]

Money statement.

July 1, 1898, balance unexpended		$321,269.85
Amount appropriated by sundry civil act approved March 3, 1899		58,500.00
Amount appropriated by sundry civil act approved July 1, 1898		450,000.00
		829,769.85
June 30, 1899, amount expended during fiscal year		265,593.11
July 1, 1899, balance unexpended		564,176.74
July 1, 1899, outstanding liabilities	$44,457.93	
July 1, 1899, amount covered by uncompleted contracts	1,029,447.56	
		1,073,905.49
Amount (estimated) required for completion of existing project		1,192,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$400,000.00	
For maintenance of improvement	25,000.00	
		425,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Amount and date of all appropriations for this work are as follows:

By act of Congress—	
Approved August 5, 1886	$18,750
Of August 11, 1888	100,000
Approved September 19, 1890	100,000
Approved July 13, 1892	100,000
Of August 18, 1894	110,000
Passed June 3, 1896	20,000
Approved June 4, 1897	350,000
Approved July 1, 1898	450,000
Approved March 3, 1899	58,500
Total	1,307,250

Total expenditures, including June 30, 1899, $743,073.26.

Abstract of proposals for furnishing and delivering one schooner load of coal at North Island, South Carolina, received in response to advertisement dated April 15, 1899, and opened May 1, 1899, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Brand.	Amount of bid per ton.
1	Georgetown Grocery Co	Georges Creek	$2.75
2	J. I. Hazard	do	2.64½
3	Wm. Johnson & Co	Pocahontas	2.89
4	Consumers' Coal Co	New River	3.18

List of contracts in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing jetties at Winyaw Bay	R. G. Ross	June 10, 1897	July 1, 1897	July 1, 1902
Schooner load of coal	J. I. Hazard	June 5, 1899	June 13, 1899	June 17, 1899

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Georgetown, S. C., from January 1, 1888, to December 31, 1898.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	352	124,155	2,818	2	479	14	1	81	8	355	124,715	2,840
1889	365	128,705	2,920	2	424	10	1	149	7	368	129,278	2,943
1890	385	165,785	3,150	6	1,346	42	1	106	6	392	167,237	3,198
1891	420	191,651	4,035	1	245	7	2	292	14	423	192,188	4,056
1892	453	215,067	4,610	1	249	7	2	439	14	456	215,775	4,631
1893	506	318,156	4,813	1	241	7	....	....	....	507	318,397	4,820
1894	567	337,520	5,240	4	897	29	3	622	21	574	339,039	5,290
1895	581	339,020	5,386	2	467	14	....	....	....	583	339,487	5,400
1896	563	397,763	5,407	....	....	....	....	....	....	563	397,763	5,407
1897	541	380,176	5,016	1	318	7	....	....	....	542	380,494	5,023
1898	417	301,163	4,370	....	....	....	....	....	....	417	301,163	4,370

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	342	121,715	2,735	8	1,835	55	1	81	8	351	123,631	2,798
1889	357	126,965	2,856	6	1,494	45	1	149	7	364	128,608	2,908
1890	372	160,458	3,069	9	1,978	63	2	355	13	383	162,791	3,145
1891	384	164,562	3,986	9	2,719	69	1	149	7	394	167,420	4,062
1892	396	187,963	4,094	5	1,173	33	3	537	19	404	189,673	4,146
1893	428	193,763	4,318	4	985	27	1	174	7	433	194,922	4,352
1894	472	207,447	4,626	8	2,035	56	3	611	21	483	210,093	4,703
1895	491	209,341	4,786	3	624	21	....	....	....	494	209,965	4,807
1896	459	201,561	4,580	3	736	23	....	....	....	462	202,297	4,603
1897	403	176,190	4,067	1	156	6	....	....	....	404	176,346	4,073
1898	320	203,061	3,760	....	....	....	....	....	....	320	203,061	3,760

Commerce, foreign and domestic.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$3,125,000	$2,750,000	$32.44
1889	3,265,000	2,975,000	....
1890	3,454,000	3,175,000	60.54
1891	3,291,407	6,395,000	11.64
1892	3,989,040	7,347,568	14.82
1893	4,100,040	7,349,575	7.23
1894	4,364,159	7,821,123	45.60
1895	4,397,791	7,890,046	236.72
1896	4,934,762	7,074,691	....
1897	4,000,651	6,200,865	....
1898	3,791,692	4,071,966	....

Total commerce.

Year.	Amount.	Year.	Amount.
1888	$5,875,000	1893	$11,449,615
1889	6,240,000	1894	12,185,282
1890	6,629,000	1895	12,287,837
1891	9,809,077	1896	12,009,453
1892	11,336,608	1897	10,201,516

A. McP. HAMBY, Jr., *Collector.*

COMMERCIAL STATISTICS, WINYAH BAY AND GEORGETOWN, S. C.

	1896.			1897.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Passengers	10,000	....	$20,000	9,000	....	$18,000
Cotton .... bales	10,000	2,500	400,000	8,000	2,100	320,000
Rough rice .... bushels	210,000	4,620	210,000	300,000	6,600	300,000
Cleaned rice .... barrels	20,000	4,400	300,000	30,000	5,870	405,000
Rice flour .... bushels	15,000	150	2,250	18,000	175	2,700
Rosin, pitch, and tar .... barrels	160,000	32,800	240,000	140,000	28,000	210,000
Spirits turpentine .... do	27,000	6,750	378,000	22,000	5,500	308,000
Cross-ties	252,000	17,640	100,800	100,000	15,000	25,000
Lumber .... feet B. M	30,500,000	50,833	457,500	20,000,000	38,124	300,000
Shingles	20,300,000	10,150	121,800	15,000,000	7,614	37,500
Clams .... barrels	4,000	1,000	10,000	1,500	375	3,750
Canned goods, pickles, etc	....	83	10,000	....	83	10,000
Poultry and eggs	....	1	1,000	....	1	1,000
Wool and hides	....	7	2,000	....	7	2,000
Miscellaneous	....	625	25,000	....	625	25,000
General merchandise, grain, machinery, and manufactured products	....	10,000	1,000,000	....	10,000	1,100,000
Total	....	141,559	3,278,350	....	120,074	3,076,950
INWARD FREIGHTS.						
General merchandise, fertilizers, machinery, rough rice, etc	....	29,500	2,950,000	....	29,300	2,750,000
Grand total	....	171,059	6,228,350	....	149,374	5,817,950

	1898.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Passengers .... fares	8,500	....	$17,000
Cotton .... bales	11,000	2,750	396,000
Rice, rough .... bushels	285,000	6,270	327,750
Rice, clean .... barrels	28,500	4,631	441,750
Rice flour .... bushels	34,200	342	5,130
Rosin, pitch, and tar .... barrels	135,000	27,000	202,500
Spirits turpentine .... do	20,000	5,000	280,000
Cross-ties	75,000	6,250	18,750
Lumber .... feet B. M	15,000,000	30,000	225,000
Shingles	10,000,000	5,000	25,000
Clams .... barrels	2,000	200	5,000
Canned goods and pickles	....	125	15,000
Wool, hides, and furs	....	9	2,500
Poultry and eggs	....	1	1,500
Miscellaneous	....	625	25,000
General merchandise, grain, machinery, and manufactured products	....	9,100	1,000,000
		97,303	2,987,880
Imports, consisting of general merchandise, fertilizers, machinery, rough rice, etc	....	27,700	2,600,000
Total	....	125,003	5,587,880

Two new lines of transportation have been established.

Commerce, 1899.

	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Passengers	2,000	....	$24,000
Cotton ... bales	15,316	3,827	505,028
Rough rice ... bushels	316,588	6,965	395,735
Clean rice ... barrels	31,658	5,276	506,528
Rosin, pitch, and tar ... do	90,953	18,191	181,906
Spirits of turpentine ... do	18,111	4,528	271,665
Cross-ties	62,621	4,383	15,656
Lumber ... feet B. M.	16,965,315	33,930	254,479
Shingles	9,377,575	4,688	65,643
Clams ... barrels	3,500	875	8,750
Canned goods, pickles, etc	....	52	16,000
Wool, hides, and furs	....	5	3,000
Poultry and eggs	....	2	2,000
Fish and game	....	1,500	150,000
Miscellaneous	....	600	30,000
Grain, machinery, general merchandise, and manufactured products	....	10,000	1,000,000
	....	94,822	3,430,389
INWARD FREIGHTS.			
General merchandise, fertilizers, machinery, timber, etc	....	28,600	2,750,000
Total	....	123,422	6,180,389

N 6.

IMPROVEMENT OF SANTEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For description of river see page 916, Annual Report for 1880. For full history of work see page 1036, Annual Report for 1886. For new project and map of river see pages 1184 and 1186, Annual Report for 1889. For statement showing comparative cost of dredging by contract and by hired labor see pages 1171 and 1172, Annual Report for 1896, and page 1459, Annual Report for 1897. For miscellaneous expenses see pages 1458 and 1459, Annual Report for 1897.

WORK OF PAST YEAR.

Dredging in the Estherville-Minim Creek Canal was continued during the year. The canal, which had an original width of from 50 to 60 feet and depth of 6 to 8 feet at low water, connecting Santee River with Winyah Bay, a distance of 4.8 miles, had become narrower at some places and shoaled to some extent by the caving of banks. There were removed during the year 169,660 cubic yards of material and 395 stumps, this maintaining to a great extent the original dimensions of the canal. The total cost, including all expenditures during the year, was 5½ cents per cubic yard.

There were cut 1,215 cords of wood for fuel, and 1,244 cords of wood were hauled.

Banks on the Government land were maintained to prevent overflowing tidal water from damaging adjacent rice lands.

Some snagging was done on the Santee River proper between 43 and 86 miles above the mouth. There were removed from the channel 41 logs, 32 stumps, and 59 large snags. The removal of each obstruction cost, approximately, 71 cents.

No new lines of transportation have been established during the year.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in the calendar year 1898, none.

Money statement.

July 1, 1898, balance unexpended	$8,202.86
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	28,202.86
June 30, 1899, amount expended during fiscal year	9,443.78
July 1, 1899, balance unexpended	18,759.08
July 1, 1899, outstanding liabilities	747.51
July 1, 1899, balance available	18,011.57
Amount (estimated) required for completion of existing project	82,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$22,000
Passed August 3, 1882	20,000
Approved July 15, 1884	15,000
Approved August 5, 1886	18,750
Of August 11, 1888	24,000
Approved September 19, 1890	30,000

By act of Congress—	
Approved July 13, 1892	$30,000
Of August 18, 1894	40,000
Passed June 3, 1896	48,000
Approved March 3, 1899	20,000
Total	267,750

Total expenditures, including June 30, 1899, $248,990.92.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	20,000	5,000	$850,000	22,000	5,500	$800,000
Rosin ... barrels	140,000	24,500	175,000	150,000	30,000	185,000
Spirits of turpentine ... do	25,000	4,687	350,000	26,000	5,100	355,000
Timber ... pieces	12,000	18,000	60,000	21,000	25,200	90,000
Shingles	3,000,000	1,500	15,000	3,500,000	1,750	17,500
Lumber ... feet	2,000,000	3,333	20,000	2,000,000	2,000	20,000
Railroad ties	23,000	1,610	6,900	35,000	2,800	10,500
Wool ... pounds	50,000	25	15,000	50,000	25	12,500
Hides ... do	15,000	8	1,500	20,000	10	1,600
Seed oats ... bushels	7,000	210	4,200	8,000	184	4,800
Rice ... do	100,000	2,200	150,000	140,000	3,220	175,000
Staves	500,000	500	2,500	400,000	1,000	2,200
Wood ... cords	10,000	10,000	12,000	12,000	12,000	15,000
Game and fish	....	15	1,500	....	34	1,700
Total	....	71,588	1,663,600	....	88,823	1,690,800
INWARD FREIGHTS.						
Fertilizers	....	7,500	225,000	....	4,600	230,000
Groceries, provisions, etc	....	11,667	350,000	....	6,600	330,000
Dry goods	....	4,000	225,000	....	4,500	225,000
Boots, shoes, etc	....	4,000	200,000	....	4,000	200,000
Hardware, implements, machinery	....	1,500	80,000	....	2,000	100,000
Grand total	....	100,255	2,743,600	....	110,523	2,775,800

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ....bales..	22,000	5,500	$700,000	15,000	4,200	$675,000
Rosin ....barrels..	161,000	35,000	191,000	135,000	27,000	164,000
Spirits of turpentine ....do....	26,450	5,200	361,000	23,000	4,700	318,000
Timber ....pieces..	23,000	39,400	131,000	28,000	32,400	143,000
Shingles	....	....	....	4,000,000	2,000	20,000
Lumber ....feet..	....	....	....	2,000,000	2,500	25,000
Railroad ties	46,000	3,500	13,800	62,000	4,400	18,600
Wool ....pounds..	50,000	25	12,500	50,000	25	12,500
Hides ....do....	20,000	10	12,000	25,000	13	2,000
Seed oats ....bushels..	10,000	302	6,000	11,000	256	4,950
Rice ....do....	....	....	....	80,000	1,600	48,000
Rice, rough ....do....	135,000	30,000	150,000	....	....	....
Staves	500,000	500	2,000	400,000	1,000	2,200
Wood ....cords..	10,000	10,000	12,500	15,000	15,000	15,000
Game and fish	....	45	2,300	....	34	1,750
Total	....	102,482	1,594,600	....	95,128	1,350,000
INWARD FREIGHTS.						
General merchandise	....	21,700	1,085,000	....	....	....
Fertilizers	....	....	....	....	4,800	250,000
Groceries, provisions, etc	....	....	....	....	6,000	300,000
Dry goods	....	....	....	....	4,000	200,000
Boots, shoes, etc	....	....	....	....	3,500	175,000
Hardware, implements, etc	....	....	....	....	2,000	100,000
Grand total	....	124,182	2,679,600	....	115,428	2,375,000

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ....bales..	15,000	3,750	$450,000	1,400	3,500	$427,000
Rosin ....barrels..	140,000	24,500	160,000	140,000	28,000	172,000
Spirits of turpentine ....do....	20,000	3,750	260,000	2,500	6,250	375,000
Timber ....pieces..	24,000	36,000	120,000	24,000	48,000	96,000
Lumber ....feet B. M..	3,000,000	3,000	30,000	2,500,000	4,166	25,000
Railroad ties	60,000	4,400	15,000	60,000	4,200	15,600
Wool ....pounds..	60,000	30	16,800	50,000	25	6,000
Hides ....do....	12,000	6	500	28,000	14	1,500
Seed oats ....bushels..	8,000	184	4,000	10,000	230	4,000
Rice, rough ....do....	160,000	3,520	120,000	100,000	2,200	95,000
Staves	400,000	1,000	4,000	400,000	400	2,000
Wood ....cords..	15,000	15,000	22,000	15,000	15,000	15,000
Game and fish	....	50	2,500	....	150	7,500
Shingles	5,000,000	2,500	20,000	2,000,000	1,000	8,000
Total	....	97,690	1,224,800	....	113,135	1,249,600
INWARD FREIGHTS.						
Fertilizers	....	20,000	1,000,000	....	5,000	200,000
Dry goods					3,500	175,000
Groceries, provisions, etc					6,000	280,000
Boots, shoes, etc					3,500	150,000
Hardware, machinery, etc					3,000	150,000
Grand total	....	117,690	2,224,800	....	134,135	2,204,600

Commercial statistics—Continued.

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ....bales..	15,000	4,000	$480,000	16,000	4,200	$495,000
Rosin ....barrels..	150,000	30,000	175,000	152,000	30,000	180,000
Spirits of turpentine ....do....	28,000	7,000	395,000	28,300	7,075	397,000
Timber ....pieces..	12,000	24,000	80,000	10,000	20,000	65,000
Shingles	2,000,000	1,000	8,000	2,000,000	1,000	8,000
Lumber ....feet B. M..	2,500,000	2,500	25,000	2,500,000	2,500	25,000
Railroad ties	50,000	3,500	12,500	50,000	3,500	12,500
Wool ....pounds..	70,000	35	10,500	70,000	35	10,500
Hides ....do....	2,900	14	1,740	30,000	15	1,800
Seed oats ....bushels..	12,000	192	4,200	10,000	230	4,000
Rice, rough ....do....	130,000	21,125	130,000	150,000	3,300	160,000
Staves	300,000	600	22,000	300,000	600	22,000
Wood ....cords..	15,000	17,250	15,000	15,000	17,250	15,000
Game and fish	....	90	9,000	....	100	10,000
Total	....	111,306	1,367,940	....	89,805	1,405,800
INWARD FREIGHTS.						
Fertilizers	....	7,500	210,000	....	6,500	200,000
Dry goods	....	3,700	135,000	....	3,900	147,000
Groceries, provisions, etc	....	7,000	187,000	....	7,300	191,000
Boots, shoes, etc	....	1,500	100,000	....	1,500	100,000
Hardware, machinery, etc	....	3,200	160,000	....	3,200	160,000
Grand total	....	134,206	2,159,940	....	112,205	2,203,800

The following statement for 1899 was kindly furnished by Mr. L. S. Ehrich, chairman of Georgetown Board of Trade. Mr. Ehrich says that 50 per cent of the total amount passed through the Estherville-Minim Creek Canal.

Articles.	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton ....bales..	15,000	4,000	$465,000
Rosin ....barrels..	140,000	27,000	185,000
Spirits turpentine ....casks..	26,000	6,900	440,000
Timber ....pieces..	15,000	30,000	77,000
Shingles	2,000,000	1,000	8,000
Lumber, B. M ....feet..	2,500,000	2,500	22,500
Railroad ties	40,000	3,000	11,000
Wool ....pounds..	70,000	35	11,000
Hides ....do....	5,000	2	2,000
Seed oats ....bushels..	10,000	230	4,000
Rice, rough ....do....	160,000	3,500	200,000
Staves	300,000	600	22,000
Wood ....cords..	15,000	17,250	15,000
Game and fish	....	125	17,000
Total	....	96,142	1,479,500
INWARD FREIGHTS.			
Fertilizers	....	6,500	200,000
Dry goods	....	3,900	147,000
Groceries, provisions, etc	....	7,300	191,000
Boots, shoes, etc	....	1,500	100,000
Hardware, machinery, etc	....	3,200	160,000
Grand total	....	118,542	2,277,500

This shows an increase of $73,700 and 6,337 tons over last year.

N 7.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see page 914, Annual Report for 1880. For map of river see page 1190, Annual Report for 1889.

WORK OF PAST YEAR.

Continued freshets in the river prevented work until June, 1899. During that month some snagging was done between the mouth of the river and 15 miles above. From the banks 5 trees were cut; from the channel 213 logs, 67 stumps, and 307 large snags were removed. The removal of each obstruction cost approximately 48 cents. Since June 30, 1884, 24,050 obstructions have been removed.

To maintain this improvement there will be required $6,000 per annum.

No new lines of transportation have been established.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in calendar year of 1898, none.

Money statement.

July 1, 1898, balance unexpended	$338.39
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	2,838.39
June 30, 1899, amount expended during fiscal year	23.50
July 1, 1899, balance unexpended	2,814.89
July 1, 1899, outstanding liabilities	278.11
July 1, 1899, balance available	2,536.78
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	3,500.00

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved March 3, 1881	$8,000	Approved July 13, 1892	$2,500
Passed August 2, 1882	15,000	Of August 18, 1894	2,500
Approved July 5, 1884	5,000	Passed June 3, 1896	5,000
Approved August 5, 1886	7,500	Approved March 3, 1899	2,500
Of August 11, 1888	12,000		
Approved September 19, 1890	12,500	Total	72,500

Total expenditures, including June 30, 1899, $69,685.11.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	415	104	$20,750	617	154	$21,600
Cotton-seed oil ... barrels	270	54	3,780	395	91	4,345
Cotton-seed meal	....	27½	605	135	135	2,700
Cotton-seed hulls	....	10	25	....	15	45
Cotton seed ... bushels	1,000	15	300	....	200	2,200
Rosin ... barrels	1,000	175	1,250	3,500	700	7,000
Rice, rough ... bushels	10,000	220	12,500	7,000	161	8,750
Total	....	....	39,210	....	....	46,640
INWARD FREIGHTS.						
General merchandise	....	400	12,000	....	788	39,400
Grand total	....	1,005½	51,210	....	2,244	86,040

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	570	143	$20,950	500	125	$15,000
Staves	....	....	....	5,000	10	300
Rosin ... barrels	18,000	3,600	36,000	1,400	196	1,540
Cotton-seed oil ... do	470	112	8,190	378	91	4,725
Rice, rough ... bushels	10,000	230	10,000	500	10	500
Cypress logs	....	....	....	8,000	16,000	40,000
Fertilizers	....	....	....	....	200	4,940
Oak staves	7,000	17	42	....	....	....
Hay ... tons	12	12	216	....	....	....
bales	....	....	....	....	6	84
Cotton seed ... tons	483	483	10,626	....	....	....
Linters	30	8	600	27	7	270
Cotton-seed hulls ... tons	20	20	60	....	25	75
Total	....	4,625	86,684	....	16,730	67,434
INWARD FREIGHTS.						
General merchandise and supplies	....	1,617	31,045	....	1,345	26,900
Grand total	....	6,242	117,729	....	18,075	94,334

Articles.	1895.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton ... bales	450	112	$13,500
Staves	10,000	10	200
Rosin ... barrels	1,100	193	1,375
Rice, rough ... bushels	1,000	22	750
Cypress timber ... sticks	10,000	20,000	50,000
Fertilizers from cotton-seed mills ... sacks	2,000	200	4,940
Other produce	....	40	800
Total	....	20,577	71,565
INWARD FREIGHTS.			
General merchandise	....	1,120	56,000
Grand total	....	21,697	127,565

Commercial statistics—Continued.

Articles.	1896.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	400	100	$16,000
Linters	400	100	1,200
Cotton-seed oil .... barrels..	600	142	9,000
Cotton seed	....	700	14,700
Hay .... bales..	4,000	200	4,000
Cotton-seed meal	....	125	3,125
Fertilizers	....	1,500	37,500
Timber .... sticks..	15,000	30,000	60,000
Grain .... bushels..	5,000	125	2,500
Total	....	32,992	148,625
INWARD FREIGHTS.			
General merchandise	....	1,510	75,500
Fertilizers	....	500	10,000
Grand total	....	35,002	233,525

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	500	100	$15,000	500	125	$15,000
Cotton-seed oil .... barrels..	550	125	5,000	550	125	5,000
Cotton seed	....	800	9,600	....	800	9,600
Hay .... bales..	2,000	100	2,000	2,000	100	2,000
Cotton-seed meal	....	200	4,000	....	200	4,000
Oats .... bushels..	5,000	115	2,000	5,000	88	2,000
Rice, rough .... do.....	5,000	110	5,000	5,000	110	6,250
Cotton-seed hulls	....	20	200	....	20	200
Timber .... sticks..	20,000	40,000	80,000	40,000	80,000	160,000
Total	....	41,570	122,800	....	81,568	204,050
INWARD FREIGHTS.						
Fertilizers	....	1,000	20,000	....	1,000	20,000
General merchandise	....	1,200	60,000	....	1,000	50,000
Grand total	....	43,770	202,800	....	83,568	274,050

The following figures for 1899 were furnished by Mr. J. M. Bates, of Wateree, and collected from other sources:

Articles.	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	160	40	$4,000
Cotton-seed oil .... barrels..	125	30	1,125
Hay	....	225	4,500
Cotton-seed meal	....	60	1,200
Timber .... sticks..	8,000	16,000	32,000
Grain .... bushels..	2,000	40	1,000
Total	....	16,395	43,825
INWARD FREIGHTS.			
General merchandise	....	600	30,000
Fertilizers	....	200	4,000
Total	....	17,195	77,825

N 8.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1140, Annual Report for 1885. For map of river see page 1194, Annual Report for 1889. For project and estimate for lock and movable dam at Granby see page 1184, Annual Report for 1896.

WORK OF PAST YEAR.

No work was done on this river during the year. The small balance which remains is held for the removal of such obstructions as may appear from time to time until further appropriations are made for the completion of the existing project.

To comply with the provisions of the approved project, which contemplates a thoroughly cleared channel 4 feet deep over the navigable length of the river, some dredging will be necessary. Until the shoals are removed no regular line of steamers can be run on this river.

After the projection is completed there will be required $6,000 per annum for maintenance.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year 1898, none.

Money statement.

July 1, 1898, balance unexpended	$326.48
July 1, 1899, balance unexpended	326.48
Amount (estimated) required for completion of existing project	28,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—

Approved August 5, 1886	$7,500
Of August 11, 1888	7,500
Approved September 19, 1890	5,000
Approved July 13, 1892	5,000
Of August 18, 1894	4,000
Passed June 3, 1896	2,000
Total	31,000

Total expenditures, including June 30, 1899, $30,673.52.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	100	25	$5,000	150	38	$5,250
Spirits of turpentine .... barrels..	218	41	4,360	303	80	7,575
Rosin .... do....	8,200	1,435	11,480	10,975	2,743	16,450
Cotton seed	....	....	....	....	275	2,750
Total	....	1,501	20,840	....	3,086	32,025
INWARD FREIGHTS.						
General merchandise	....	900	27,000	....	600	30,000
Grand total	....	2,401	47,840	....	3,686	62,025

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	225	56	$7,875	....	....	....
Spirits of turpentine .... barrels..	250	50	3,750	200	50	$3,500
Rosin .... do....	6,500	1,300	13,000	1,600	224	1,760
Hay .... bales..	500	75	1,500	....	....	....
Cotton seed	....	500	5,000	....	....	....
Timber .... sticks.	....	....	....	3,000	6,000	18,000
Granite .... cubic yards..	....	....	....	1,200	1,500	7,500
Total	....	1,981	31,125	....	7,774	30,760
INWARD FREIGHTS.						
General merchandise	....	800	40,000	....	200	10,000
Grand total	....	2,781	71,125	....	7,974	40,760

Articles.	1895.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	300	75	$9,000
Cotton seed .... sacks..	3,500	350	3,500
Cotton-seed meal .... do....	350	18	700
Rosin .... barrels..	2,000	350	2,500
Timber .... sticks..	4,000	8,000	20,000
Total	....	8,793	35,700
INWARD FREIGHTS.			
General merchandise	....	200	10,000
Grand total	....	8,993	45,700

Articles.	1896.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton .... bales..	500	125	$20,000
Rosin .... barrels..	2,300	460	5,750
Spirits turpentine .... do....	600	150	9,000
Hay .... bales..	11,300	565	11,300
Grain .... bushels..	8,500	170	4,250
Lumber .... feet B. M..	120,000	200	2,400
Staves:			
Oak	135,000	337	2,700
Pine	100,000	100	500
Timber .... sticks..	7,000	14,000	28,000
Total	....	16,107	83,900
INWARD FREIGHTS.			
Fertilizers	....	600	15,000
General merchandise	....	1,600	80,000
Grand total	....	18,307	178,900

Commercial statistics—Continued.

Articles.	1897.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton..........bales..	100	20	$3,000
Rosin..........barrels..	1,000	200	2,000
Spirits turpentine..........do....	200	40	3,000
Hay..........bales..	1,200	60	1,200
Grain..........bushels..	1,500	37	700
Staves, oak and pine..........	40,000	100	3,200
Timber..........sticks..	20,000	40,000	80,000
Total..........	....	40,457	93,100
INWARD FREIGHTS.			
General merchandise..........	....	300	15,000
Fertilizers..........	....	100	2,000
Grand total..........	....	40,857	110,100

Articles.	1898.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton..........bales..	400	100	$12,000
Cotton seed..........sacks..	3,500	350	3,500
Cotton-seed meal..........	....	25	500
Rosin..........barrels..	2,000	350	4,000
Spirits turpentine..........do....	200	50	3,000
Hay..........bales..	1,000	50	1,000
Grain..........bushels..	1,500	37	700
Timber..........sticks..	40,000	80,000	160,000
Total..........	....	80,962	184,700
INWARD FREIGHTS.			
General merchandise..........	....	300	15,000
Fertilizers..........	....	100	2,000
Grand total..........	....	81,362	201,700

The following statement for 1899 was collected from Mr. J. W. Bates, of Wateree, and other sources:

Articles.	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton..........bales..	110	27	$2,750
Cotton seed..........sacks..	2,500	250	2,500
Cotton-seed meal..........	....	15	300
Rosin..........barrels..	1,200	240	3,000
Spirits turpentine..........do.....	120	30	2,400
Hay..........	....	300	6,000
Grain..........bushels..	500	13	250
Timber..........sticks..	7,000	14,000	28,000
Total..........	....	14,875	45,200
INWARD FREIGHTS.			
General merchandise..........	....	125	6,250
Fertilizers..........	....	75	1,500
Grand total..........	....	15,075	52,950

N 9.

IMPROVING CONGAREE RIVER, SOUTH CAROLINA, FROM GERVAIS STREET BRIDGE, COLUMBIA, TO GRANBY.

Pursuant to House Resolution dated December 15, 1893, a project and estimate was submitted and printed as House Ex. Doc. No. 66 of that session, giving the cost of extending steamboat navigation from Granby to Gervais Street Bridge, Columbia. This document and letter concerning it are reprinted on pages 1182 to 1189, Annual Report for 1896.

The river and harbor act, approved March 3, 1899, authorized continuing contracts for constructing a lock and dam near Granby. Condemnation proceedings have been instituted for most of the land required. The estimated cost of the project is $250,000.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$50,000.00
June 30, 1899, amount expended during fiscal year	45.10
July 1, 1899, balance unexpended	49,954.90
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

N 10.

IMPROVEMENT OF HARBOR AT CHARLESTON, INCLUDING SULLIVANS ISLAND AND MOUNT PLEASANT SHORE, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For history of operations to June 30, 1888, see page 970, Annual Report for 1888. For modified project, including estimates, see page 1150, Annual Report for 1889. For full history of all operations up to and including the completion of the jetties, with full discussion of the projects and costs, see page 1189, Annual Report for 1896.

WORK OF PAST YEAR.

No stonework was done.

The dredge *Charleston* returned from Newport News, Va., July 29, after undergoing somewhat extensive repairs, and resumed work on Charleston Bar on August 1, 1898.

She removed and dumped the following amounts during the year: From the outer shoal 105,014 cubic yards and from the inner shoal 165,986 cubic yards, giving a total for the year of 271,000 cubic yards, and of 3,252,969 from the beginning of the work. This marked falling off in the annual work of the dredge is due to the fact that the vessel, now nearly 8 years old, has been in bad condition. Over three months of the twelve have been lost by her being laid up for repairs. On account of her scant freeboard, it was found to be unsafe to work her in the open ocean beyond the jetties, where most of the dredging is now needed, except when the sea was reasonably smooth. In February, 1899, the forward bin began giving away. Rods were put across it fore and aft, but it soon leaked again in spite of these. An examination showed that the woodwork of this bin was in a badly decayed condition. This local deterioration is probably due to charring from a fire which occurred when the boat was new and to the continued heat of the boilers. This last seriously affects the life of wood.

The boat also needed a new pumping engine.

Contracts were consequently made for raising the sides of the *Charleston*, so as to give her more freeboard, for replacing the forward bin, and general repairs, and also for a new pumping engine. She left Charleston for Newport News, Va., May 2, 1899, to have these repairs and changes made. Work is in active progress upon her, and it is thought that she may be again at work on Charleston Bar in August, 1899.

During the fiscal year the area between the jetties and seaward of their ends, and that between the inner (low) portion of the south jetty and Fort Sumter have been surveyed and a chart showing these surveys is submitted herewith. The sounding beyond the ends of the jetties was carried out much farther than in former surveys in order to have data for a project for obtaining 26 feet at low water.

The sum of $175,000 was appropriated by Congress to build and operate for one year a dredge much larger than the *Charleston*. Plans and specifications have been prepared for this dredge, and it is expected that she will be built by October 1, 1900.

During the year (on or about September 9) the transport *Minnewaska* came into the harbor through the jetty channel drawing but little less than 24 feet. This is the deepest draft that has ever been brought into this port.

No changes in the jetties have been noticed or reported.

The beach of Sullivans Island, just west of the jetty, is being eroded while east of this jetty it has been built up.

A few soundings were taken at the critical point of the channel on June 6, 1899, and these have been shown upon the chart submitted. A channel of not less than 20 feet at low water is shown entirely through from Charleston to the ocean.

Money statement.

July 1, 1898, balance unexpended		$122,019.62
June 30, 1899, amount expended during fiscal year		31,776.32
July 1, 1899, balance unexpended		90,243.30
July 1, 1899, outstanding liabilities	$550.00	
July 1, 1899, amount covered by uncompleted contracts	36,130.00	
		36,680.00
July 1, 1899, balance available		53,563.30
Amount (estimated) required for completion of existing project		285,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$150,000.00	
For maintenance of improvement	50,000.00	
		200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved June 18, 1878	$200,000	Approved Sept. 19, 1890	$370,000
Approved March 3, 1879	200,000	Approved July 13, 1892	225,000
Approved June 14, 1880	170,000	Approved March 3, 1893	750,000
Approved March 3, 1881	175,000	Approved August 18, 1894	450,000
Passed August 2, 1882	300,000	Approved March 2, 1895	500,000
Approved July 5, 1884	250,000	Approved March 3, 1899	175,000
Approved August 5, 1886	187,500		
Of August 11, 1888	350,000	Total	4,302,500

Total expenditures to June 30, 1899, $4,037,256.70.

Abstract of proposals for furnishing rubber suctions, received in response to advertisement dated August 3, 1898, and opened September 2, 1898, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of Bidder.	Per foot.	Amount bid each.
1	New York Belting and Packing Co. (Limited)	$14.14	$114.89
2	New Jersey Car Spring and Rubber Co	....	146.50

Abstract of proposals for furnishing wharf, storage room, and handling coal, received in response to advertisement dated August 29, 1898, and opened September 28, 1898, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Wharf, per month.	Coal, per ton.	Storage, per month.
1	Consumers' Coal Co	$30.00	$0.85	(1)
2	Boyce's wharf	40.00	(2)	(2)
3	William Johnson & Co	(2)	.95	$3.50

(1) Free. (2) No bid.

Abstract of proposals for furnishing and delivering schooner load of coal, received in response to advertisement dated November 7, 1898, and opened December 7, 1898, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Brand.	Amount bid per ton.
1	William Johnson & Co	Pocahontas	$2.83
		Georges Creek Big Vein	2.70
2	Consumers' Coal Co	Pocahontas	3.20
		Georges Creek	2.68
		New River	3.20
3	Hugh Ferguson & Co	Georges Creek Elk Garden	2.45

Abstract of proposals for furnishing one new pumping engine for dredge Charleston, received in response to advertisement dated December 10, 1898, and opened January 10, 1899, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Amount bid.
1	E. M. Bailey Co. (Informal)	$2,435.00
2	....do	3,288.50 3,165.00 4,290.00 2,325.00
3	....do	3,262.50
4	....do	2,940.00
5	....do	4,290.00
6	....do	3,165.00

Abstract of proposals for furnishing and installing new pumping engine in dredge Charleston and removing old, received in response to advertisement dated January 17, 1899, and opened February 17, 1899, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Amount bid.
1	Valk & Murdoch Iron Works	$3,600.00
2	Newport News Ship Building and Dry Dock Co	5,210.00

Abstract of proposals for docking, raising hull, and repairing dredge Charleston, received in response to advertisement dated March 13, 1899, and opened April 13, 1899, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Amount bid.
1	Louis H. Skinner	$34,867.24
2	Burlee Dry Dock Co	32,651.40
3	Newport News Ship Building and Dry Dock Co	32,479.17

List of contracts in force.

Contract for.	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Rubber suctions	New York Belting and Packing Co.	Nov. 26, 1898	Oct. 20, 1898	Oct. 20, 1900.
Wharf, storage, and handling coal.	Consumers Coal Co	Nov. 28, 1898	Dec. 1, 1898	Dec. 1, 1900.
Furnishing new pumping engine and removing old from dredge.	Valk & Murdoch Iron Works.	Mar. 28, 1899	Mar. 18, 1899	Aug. 1, 1899.
Docking, raising hull, and repairing dredge Charleston.	Newport News Ship Building and Dry Dock Co.	June 8, 1899	June 15, 1899	Rapidly as consistent with good work.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Charleston, S. C., from January 1, 1875, to December 31, 1899.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	504	382,018	11,949	38	13,144	326	198	88,879	2,404	740	484,041	14,379
1876	471	340,439	10,113	44	11,898	335	224	101,272	2,768	739	453,609	13,216
1877	400	324,919	9,885	32	13,972	308	336	105,480	2,851	668	444,371	13,044
1878	396	322,527	9,628	44	19,935	455	332	163,368	3,967	772	505,830	14,045
1879	383	326,681	10,027	39	12,505	319	249	121,503	3,292	668	460,659	13,638
1880	441	388,026	20,641	38	12,412	327	191	110,771	2,595	670	511,209	13,563
1881	412	399,732	10,377	34	9,430	272	257	121,077	3,073	703	530,239	13,722
1882	410	384,690	9,446	35	4,807	224	200	105,647	2,648	645	495,144	12,318
1883	345	277,538	7,629	26	3,002	157	239	113,768	2,958	610	394,308	10,744
1884	425	304,362	9,822	21	3,910	145	214	134,076	3,269	690	442,368	13,236
1885	375	268,477	9,637	15	2,344	97	187	106,233	2,586	577	377,054	12,320
1886	901	550,209	....	20	3,714	131	182	114,507	2,646	1,103	668,408	....
1887	927	656,949	....	30	7,074	199	127	67,257	1,607	1,084	731,280	....
1888	*a* 924	601,771	....	34	7,750	252	127	72,921	1,779	1,085	682,442	....
1889	*b* 339	481,718	9,708	30	6,985	216	136	87,101	1,979	496	575,804	11,903
1890	*c* 410	600,776	13,677	35	7,205	242	120	81,518	1,828	565	689,499	15,745
1891	*d* 417	680,776	15,695	27	4,665	179	150	119,199	2,383	594	804,640	18,257
1892	*e* 388	625,880	14,705	28	5,138	193	87	69,091	1,416	506	700,109	16,814
1893	*f* 338	566,923	13,106	28	6,622	202	108	92,562	1,970	474	666,077	15,278
1894	*g* 327	574,423	13,155	22	4,765	137	100	100,213	1,856	449	679,401	15,148
1895	*h* 369	625,121	14,328	21	5,569	197	57	51,666	999	447	682,356	15,524
1896	*i* 333	588,438	14,251	22	7,058	170	74	75,564	1,390	429	666,060	15,811
1897	*j* 458	782,031	19,135	10	3,495	125	107	133,486	2,267	575	919,012	21,527
1898	*k* 420	708,175	16,740	14	9,347	251	91	109,043	2,000	525	826,565	18,991

a Of these, 32 vessels (tonnage, 31,085), with crews numbering 608, were foreign.
b Of these, 29 vessels (tonnage, 9,440), with crews numbering 546, were foreign.
c Of these, 58 vessels (tonnage, 55,533), with crews numbering 1,110, were foreign.
d Of these, 34 vessels (tonnage, 39,078), with crews numbering 717, were foreign.
e Of these, 31 vessels (tonnage, 30,949), with crews numbering 562, were foreign.
f Of these, 31 vessels (tonnage, 36,156), with crews numbering 633, were foreign.
g Of these, 9 vessels (tonnage, 12,025), with crews numbering 212, were foreign.
h Of these, 22 vessels (tonnage, 20,936), with crews numbering 487, were foreign.
i Of these, 15 vessels (tonnage, 24,399), with crews numbering 386, were foreign.
j Of these, 4 vessels (tonnage, 6,327), with crews numbering 114, were foreign.
k Of these, 10 vessels (tonnage, 14,345), with crews numbering 237, were foreign.

Arrivals and clearances of vessels and commerce at Charleston, S. C., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	461	328,266	10,830	57	24,679	555	211	94,595	2,527	729	447,540	13,912
1876	431	278,744	9,095	60	23,598	546	230	103,276	2,812	721	405,618	12,453
1877	335	234,429	7,719	35	22,767	423	250	108,446	2,910	620	365,662	11,052
1878	266	172,988	5,801	45	24,397	479	398	149,975	3,591	509	347,360	14,045
1879	287	188,212	6,268	34	11,282	292	278	149,052	3,643	599	348,546	10,203
1880	296	190,733	6,348	45	23,210	481	246	155,768	3,375	587	369,711	10,204
1881	268	187,569	5,942	32	9,239	255	278	153,796	3,464	578	350,604	9,661
1882	147	113,699	3,690	40	7,375	273	263	158,250	3,584	450	379,324	7,546
1883	98	48,714	2,018	27	4,560	181	299	154,653	3,815	424	207,927	6,014
1884	212	116,020	4,555	31	7,845	217	276	161,588	3,727	519	285,453	8,499
1885	191	99,658	5,047	24	5,217	164	204	119,602	2,836	419	224,467	8,047
1886	890	543,259	....	25	5,469	165	201	126,943	2,875	1,116	675,671	....
1887	888	610,646	....	28	5,837	189	178	115,218	2,546	1,089	731,701	......
1888	*a* 911	580,468	....	30	5,848	211	144	96,146	2,105	1,085	662,462	....
1889	*b* 46	358,596	778	25	5,080	174	165	112,037	2,495	236	155,713	3,467
1890	*c* 21	12,863	292	41	10,161	318	166	126,078	2,676	228	149,102	3,286
1891	*d* 39	21,197	436	32	6,887	216	164	143,398	2,809	255	171,482	3,461
1892	*e* 26	29,752	565	28	5,760	197	111	89,890	1,798	165	124,902	2,560
1893	*f* 49	47,756	978	29	5,761	198	100	88,421	1,671	178	141,938	2,847
1894	*g* 46	36,760	723	22	5,422	152	90	97,769	1,715	158	139,951	2,590
1895	*h* 84	86,420	1,915	13	2,283	96	72	81,420	1,331	169	170,123	3,342
1896	*i* 69	90,106	1,882	8	1,487	51	67	74,216	1,343	144	165,809	3,276
1897	*j* 96	106,359	1,879	7	1,364	49	77	88,405	1,538	180	196,128	3,406
1898	*k* 63	74,803	1,435	7	3,518	116	79	92,272	1,768	149	170,593	3,319

a Of these, 7 vessels (tonnage, 4,295), with crews numbering 62, were foreign.
b Of these, 4 vessels (tonnage, 2,960), with crews numbering 47, were foreign.
c Of these, 7 vessels (tonnage, 6,186), with crews numbering 135, were foreign.
d Of these, 18 vessels (tonnage, 16,332), with crews numbering 303, were foreign.
e Of these, 13 vessels (tonnage, 15,068), with crews numbering 261, were foreign.
f Of these, 29 vessels (tonnage, 31,810), with crews numbering 554, were foreign.
g Of these, 19 vessels (tonnage, 15,795), with crews numbering 292, were foreign.
h Of these, 11 vessels (tonnage, 10,325), with crews numbering 222, were foreign.
i Of these, 18 vessels (tonnage, 22,047), with crews numbering 363, were foreign.
j Of these, 40 vessels (tonnage, 58,108), with crews numbering 994, were foreign.
k Of these, 22 vessels (tonnage, 30,941), with crews numbering 505, were foreign.

All coastwise vessels not required to clear.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.	Year.	Value of exports.	Value of imports.	Duties collected.
1875	$19,655,966	$680,343	$80,656.00	1887	$15,288,316	$484,063	$30,817.00
1876	18,088,152	455,562	89,168.00	1888	13,006,578	625,770	76,398.00
1877	16,917,492	161,237	46,848.00	1889	16,080,255	664,696	16,728.82
1878	21,167,575	184,127	36,990.00	1890	15,204,771	836,626	18,356.81
1879	18,693,126	127,981	24,070.00	1891	21,906,076	1,204,588	24,308.47
1880	24,939,259	248,158	46,453.98	1892	11,460,681	368,926	15,494.24
1881	21,927,269	723,049	99,066.23	1893	11,056,287	883,842	16,689.75
1882	19,907,099	459,970	45,263.33	1894	10,877,048	683,324	28,423.01
1883	20,144,365	467,648	48,760.69	1895	10,063,605	522,721	31,370.26
1884	20,833,424	503,504	36,624.70	1896	11,144,669	641,177	19,997.81
1885	15,157,889	588,191	32,741.68	1897	10,807,728	1,299,035	76,802.23
1886	17,410,000	635,000	24,876.00	1898	9,768,326	1,187,924	139,226.63

N 11.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see page 1073, Annual Report for 1881. For modified project see page 1196, Annual Report for 1889. For map of Wappoo Cut see page 1476, Annual Report for 1891.

WORK OF PAST YEAR.

No work has been done, the amount available being too small to do such dredging as is needed to secure the projected depth of 6 feet at low water.

Money statement.

July 1, 1898, balance unexpended	$1,284.53
June 30, 1899, amount expended during fiscal year	.38
July 1, 1899, balance unexpended	1,284.15
Amount (estimated) required for completion of existing project	25,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	4,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved March 3, 1881	$10,000	Approved July 13, 1892	$10,000
Passed August 2, 1882	10,000	Of August 18, 1894	7,000
Approved July 5, 1884	3,000	Passed June 3, 1896	2,500
Approved August 5, 1886	5,000		
Of August 11, 1888	5,000	Total	62,500
Approved September 19, 1890	10,000		

Total expenditures, including June 30, 1899, $61,215.85.

COMMERCIAL STATISTICS.

Articles.	1888		1889.	
	Quantity.	Value.	Quantity.	Value.
Phosphate rock ... tons..	60,000	$300,000	70,000	$475,000
Sea-island cotton ... bags..	6,000	360,000	10,000	750,000
Rice ... bushels..	150,000	150,000	250,000	262,500
Vegetables ... crates..	120,000	240,000	80,000	125,000
Fertilizers ... tons..	2,000	30,000	2,500	40,000
Lumber ... feet..	20,000,000	160,000	22,500,000	190,000
Shingles, cross-ties, and other articles				25,000
Total		1,240,000		1,867,500

Articles.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
Phosphate rock ... tons..	75,000	$525,000	65,000	$300,000
Sea-island cotton ... bags..	12,000	800,000	10,000	850,000
Rice ... bushels..	240,000	250,000	400,000	300,000
Vegetables ... crates..	90,000	160,000	95,000	200,000
Fertilizers ... tons..	1,400	21,000	3.000	37,500
Lumber ... feet..	25,000,000	200,000	30,000,000	275,000
Shingles, cross-ties, and other articles		20,000	50,000	35,000
Total		1,976,000		1,997,500

Commercial statistics from January 1 to December 31, 1893.

Articles.	Number.	Tons.	Value.
Phosphate rock		78,500	$395,500
Sea-island cotton ... bags..	5,000		450.000
Rice ... bushels..	360,000		350,000
Vegetables ... crates..	120,000		260,000
Fertilizers		4,300	70,000
Lumber ... feet..	35,000,000		290,000
Shingles and other articles		60,000	50,000
Total		142,800	1,865,500

Commercial statistics, Wappoo Cut, South Carolina, 1895.

Articles.	Number.	Tons.	Value.
Phosphate rock		75,000	$325,000
Sea-island cotton ... bags	3,600	600	225,000
Rice ... bushels	425,000	18,750	425,000
Vegetables ... crates	125,000	6,000	250,000
Fertilizers		3,000	58,000
Timber, lumber, wood ... feet	40,000,000	80,000	340,000
Shingles, cross-ties, and other articles		55,000	60,000
Total		238,350	1,683,000

Summary of business from January 1 to December 31, 1895.

Articles.	Number.	Tons.	Value.
Phosphate rock		80,000	$300,000
Sea-island cotton ... bags	6,200	950	420,000
Rice ... barrels	70,000	10,000	800,000
Vegetables ... crates	136,000	780	265,000
Fertilizers		3,500	60,100
Lumber ... feet	50,000,000	95,000	350,000
Shingles and miscellaneous articles		60,000	65,000
Total		250,230	2,260,100

Commercial statistics, January 1 to December 31, 1896.

Articles.	Number.	Tons.	Value.
Phosphate rock		85,000	$325,000
Sea-island cotton ... bags	7,000	1,000	460,000
Rice ... barrels	68,000	9,800	780,000
Vegetables ... crates	185,000	1,200	325,000
Fertilizers		7,000	75,000
Lumber ... feet	55,000,000	98,000	375,000
Shingles and other miscellaneous articles		70,000	70,000
Total		272,000	2,410,000

N 12.

IMPROVEMENT OF BEAUFORT RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1235, Annual Report for 1890.
For reason for increasing estimate see page 1529, Annual Report for 1893.

During the year no work was done.

This river is tributary to the collection district of Beaufort, S. C. Beaufort is the port of entry. Amount of duties collected in calendar year 1897, $2,537.37.

Money statement.

July 1, 1898, balance unexpended	$568.29
July 1, 1899, balance unexpended	568.29
Amount (estimated) required for completion of existing project	9,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved September 19, 1890	$12,500
Approved July 13, 1892	12,500
Of August 18, 1894	5,000
Passed June 3, 1896	1,000
Total	31,000

Total expenditures to and including June 30, 1899, $30,431.71.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Beaufort, S. C., from January 1, 1888, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	103	121,207	2,630	3	1,093	26	30	21,785	422	136	144,085	3,078
1889	98	128,834	2,728	2	1,461	19	58	54,464	1,096	158	230,193	3,853
1890	43	49,173	927	7	2,987	75	52	48,656	972	102	100,816	1,974
1891	37	40,145	786	3	1,567	26	22	21,503	416	62	63,215	1,222
1892	29	34,979	607	1	896	9	37	43,526	771	67	79,401	1,387
1893	40	51,967	854	4	3,101	38	36	45,774	771	80	100,842	1,663
1894	29	39,171	681	3	2,925	32	41	72,469	1,220	73	114,565	1,993
1895	35	47,397	823	1	1,005	12	30	51,912	1,095	66	100,314	2,039
1896	18	26,978	467	2	1,716	22	33	54,780	968	53	83,474	1,457
1897	11	17,751	262	3	1,981	26	25	42,564	792	39	61,246	1,080

CLEARED.

1888	57	63,287	1,566	3	1,465	33	78	85,523	1,561	138	150,275	3,160
1889	57	73,744	1,872	.....	....	....	98	99,898	1,944	155	173,642	3,816
1890	12	6,436	127	1	101	14	88	94,285	1,828	101	100,822	1,969
1891	7	3,921	75	.....	....	....	51	56,300	932	58	60,221	1,007
1892	7	4,268	92	.....	....	....	59	72,702	1,264	66	76,970	1,356
1893	6	6,313	110	1	296	8	67	92,248	1,494	74	98,857	1,612
1894	5	6,237	118	1	296	8	60	101,629	1,714	66	108,162	1,840
1895	5	5,902	89	.....	....	....	66	100,843	1,929	71	106,745	2,018
1896	7	8,918	127	.....	....	....	44	73,656	1,282	51	82,519	1,409
1897	3	5,644	77	.....	....	....	33	54,057	972	39	59,701	1,049

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$850,393.00	$65,645.36	$17.00
1889	1,083,085.00	24,266.00	160.00
1890	1,040,197.00	41,005.00	....
1891	627,851.00	137,942.54	31.50
1892	791,554.00	77,751.49	....
1893	2,251,685.50	19,278.31	9.00
1894	4,939,417.00	59,054.00	182.00
1895	4,155,619.00	70,382.32	1,529.00
1896	4,316,259.00	135,482.62	1,490.40
1897	2,605,896.00	84,651.07	2,537.37

N 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The steam tug *Douglass* sank in the draw of the Charleston and Savannah Railroad Bridge over Ashley River and was reported as an obstruction to navigation. The removal of this wreck was authorized and the sum of $1,500 allotted for this purpose. The contract was awarded to B. F. Kramer, of Charleston, after advertising twice. The hull of the boat was of iron, and in removal she broke in half. All of the parts of the hull and boiler were removed and placed at or near low water on the west side of Ashley River, near the bridge, where they are out of the way.

The pilot boat *Sprite*, which sank in Beaufort River, near the naval station, was reported as an obstruction to navigation, and $1,000 was allotted for its removal. An informal agreement was entered into with Mr. Jerrie Potter, of Beaufort, S. C., who failed to complete the work. It was then readvertised, and under informal agreement with Messrs. Townsend Brothers, of Charleston, was finally removed in March, 1899.

Complaint was made by persons interested in rice planting on Ashepoo River that the wrecks of three lighters in the Horseshoe branch of this river almost completely obstructed its navigation. This was found to be practically true from an examination made in September, 1898. The amount of $1,000 was allotted for the removal of the wrecks, and the work was done under informal agreement with Mr. B. F. Kramer, of Charleston, S. C. These lighters were raised and sold on the river for the sum of $100. They were subsequently removed from the river entirely by the purchasers.

Abstract of proposals for removing wreck of tug "Douglas," received in response to poster and circular letter dated July 22, 1898, and opened August 22, 1898, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Amount bid.
1	John C. Ross	$1,568
2	P. R. Rivers	465
3	John G. Smith	1,475

The contract was awarded to Mr. P. R. Rivers, the lowest bidder, who failed to enter into contract. The other bids being considered as unreasonable, the work was readvertised.

Abstract of proposals for removing tug "Douglas," received in response to poster and circular letter dated September 19, 1898, and opened October 19, 1898, by Maj. E. H. Ruffner, Corps of Engineers.

No.	Name of bidder.	Amount bid.
1	B. F. Kramer	$600
2	C. O. Campbell	875
3	Verden & Ross	1,850

N 14.

REPORT UPON THE POSSIBILITY OF PROVIDING DEEPER DRAFT AT ENTRANCE TO CHARLESTON HARBOR, SOUTH CAROLINA, WITH PLAN AND ESTIMATE OF COST OF SECURING A DEPTH OF 26 FEET AT LOW WATER FROM THE OCEAN TO DEEP WATER INSIDE SAID HARBOR.

[Printed in House Doc. No. 83, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 14, 1898.

SIR: I have the honor to return herewith concurrent resolution No. 10, Fifty-fifth Congress, second session, adopted by the House of Representatives April 5, 1898, the Senate concurring April 6, 1898, which said resolution provides as follows:

> That the Secretary of War be, and is hereby, requested to furnish the House of Representatives, at the earliest time practicable, such information as he may have regarding the possibility of providing deeper draft at the entrance into Charleston Harbor than is contemplated by the approved project for the improvement by jetties of the entrance to that harbor; and that he be requested, further, to submit a plan and estimate of the cost of securing a depth of not less than twenty-six feet at low water from the ocean to deep water inside the harbor, and to report his opinion as to the advisability thereof.

In answer to the reference of this resolution to this office, I beg to submit the accompanying copy of report, with maps, by Maj. E. H. Ruffner, Corps of Engineers, dated November 18, 1898, in which he submits plan and estimate of cost of securing a channel depth of 26 feet at low water from Charleston Harbor to the ocean. This plan, briefly stated, provides for the construction of two dredges, each capable of removing 4,000 cubic yards of material per day, the first cost of which, together with operating expenses, including contingencies for three years, is estimated at $420,000; raising inner ends of both existing jetties to high-water level at an estimated cost of $668,458, and, if deemed necessary, the extension of both jetties seaward at an estimated cost of $1,320,094; total estimate of cost submitted by Major Ruffner, $2,408,552.

From this report it appears that it is quite possible to secure a deeper channel at the entrance to Charleston Harbor than exists at present. Major Ruffner is of the opinion that while a draft of 24 feet would undoubtedly accommodate all coastwise business, it is certain from a military and naval point of view that this harbor should be made accessible to our largest vessels. He states that in his opinion an expenditure of $1,500,000, which would make this harbor accessible to our men-of-war within three years, is highly desirable.

The division engineer, Col. Peter C. Hains, Corps of Engineers, differs from the local engineer in regard to certain portions of the plans proposed, and states that in his opinion a channel 26 feet deep can be formed by an extension of the existing jetties, supplemented by dredging, and that it might not be impossible to secure such a channel and maintain it by dredging alone. His recommendation is that the desired depth be first obtained by dredging, and if it should be found later that dredging alone would not maintain the channel, the jetties could be extended.

In my opinion, a greater channel depth at the entrance to Charleston Harbor is both possible and desirable, and if it be the will of Congress that the work be carried out, I recommend the work be inaugurated by an appropriation of not less than $250,000, which, it is estimated, will be required in addition to the balance remaining available for Charleston Harbor, for the construction of one additional dredge and for the operating expenses during the next three years of the new dredge and of the dredge now available.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJOR E. H. RUFFNER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., November 18, 1898.

GENERAL: In obedience to your instructions of April 7, the following report is submitted in compliance with House concurrent resolution No. 10, Fifty-fifth Congress, second session. The resolution calls for information regarding the possibility of providing deeper draft at the entrance into Charleston Harbor than is contemplated by the approved project for the improvement by jetties of the entrance to that harbor, and the Secretary of War is requested, further, to submit a plan and estimate of the cost of securing a depth of not less than 26 feet at low water from the ocean to deep water inside the harbor, and to report his opinion as to the advisability thereof.

Charleston Harbor has been under improvement for a number of years, and a well-defined and precise project for securing a certain depth of water in the main channel has been executed successfully, and the desired depth is now to be found throughout the entire channel. In point of fact, a greater depth exists throughout this channel than the project contemplates, except in limited areas, notably over a bar to seaward of the jetty ends. The plan of improvement consisted of the building of two long jetties from the island shores north and south of the harbor entrance, carrying these jetties by long, easy curves to a final parallelism out to water deep enough to insure the action of the tidal currents in one and the same direction, and to protect the channel, when formed, from being filled with sand by wave action during storms.

To form the channel, two processes are required. The tidal currents sweep a certain amount of the sand and gravel lying between the jetties in either direction, mainly to seaward. This scour has a complex movement. A portion of the material moved is taken up from one area and is deposited farther seaward, between the jetties. In this way shoals are moved seaward slowly, showing in the surveys in successive years as well-marked crests, and on each chart farther outward. Not all of this sand, once set in motion, is dropped, however; part of it is carried to sea, disappearing entirely from the surveyed areas, and represented in our profiles and plats as "scour." Powerful as is the action of the tidal currents, it requires many years to secure a general deepening of the tidal channel, and dredging is always necessary to hasten this action and to localize it. The path of the selected channel between the jetties lay originally over a wide, flat ocean bar, composed of heavy material, and with a scant depth of water over it. Dredging was at first difficult, because of this scant depth, and the dredge planned to operate on this shoal was especially designed to work under these conditions. During the first few years the dredge removed large quantities of material; but as the channel deepened, and material became tougher, or harder to start, the total dredging is less. The machine is wearing out, too, and from all these causes the total output falls off from 500,000 cubic yards per annum to 390,000. Moreover, the tendency to deposit just beyond the ends of the jetties at least a portion of the heavy material of the scour from between the jetties, combined with the outward rolling or pushing movement of the shoals moving seaward, makes an outer bar that must be removed as fast as possible in order to form and to maintain a good channel.

This outer bar is not always accessible to a dredge of the small capacity of the present one, designed for another purpose. The dredge can not work there in heavy weather, or with a swell on, and hence the deepening of this particular spot is a slow and uncertain process. In point of fact, there is good reason to believe that if we had a dredge powerful enough to remove 4,000 cubic yards a day, and capable of working in all except stormy weather at the outer end and seaward of the jetties, a channel would soon be secured of at least 24 feet at low tide that could be carried entirely through the jetties.

With this preliminary sketch of existing conditions we are prepared to look at what is necessary to secure a depth from ocean to harbor of 26 feet at low water.

First. The question of the capacity of the existing tidal currents must be considered. The time since the jetties were finished is entirely too short to enable us to state precisely what they are capable of doing. We have calculations deduced from our surveys showing how the mean depths over certain areas between the jetties vary, and from these the total scour is ascertained. A table is given showing some of these features. From this it will be seen that this scour has been very great. But it must be borne in mine that the conditions will be greatly changed should it be expected that a longer and deeper channel is required. It might not follow that the evidence of this powerful scouring action would be as clear under the altered conditions as in the past.

From the Report of 1896 (p. 1198) it is seen that the total deepening between the jetties from 1884 to that date corresponded to a disappearance of 4,094,247 cubic yards. The amount removed by dredging during the same interval was 2,205,544, and the jetty scour aggregated 2,779,244 cubic yards. The following year the Report (p. 1472) gave 100,000 cubic yards as the amount removed by scour, unaided by dredging. The surveys of 1898 are not full enough to enable this comparison to be continued, but we learn that the scour is of importance, because the areas of shoal water between the extended lines of the jetties and beyond the ends are diminished.

	June, 1897.	June, 1898.	Nov., 1898.
The area of less than—	*Acres.*	*Acres.*	*Acres.*
21 feet at low water in	153	144	135.5
18 feet at low water in	82	77	73
15 feet at low water in	48	45	38.5
12 feet at low water in	8	6	6.5

It is quite apparent, however, that although the jetties may be depended upon to maintain any channel that is dredged, the scouring action due to tidal currents alone will not hereafter make any appreciable difference in the deepening of the channel. From all the experience of the past, including so much of that experience as is summarized here, the broad statement can be made that the creation of the desired channel will be due entirely to dredging. The scour of the jetties is necessarily more or less distributed over the entire width of the jetty channel, say 3,000 feet, and the ship channel will be only about 300 feet wide, certainly for some years to come. To obtain the additional depth called for to secure 26 feet, there will be required less and less depth of dredging as the channel is extended beyond its present end to the new end. But the presence of the outer bar has already forced dredging operations to be carried some 4,800 feet beyond the end of the south jetty, and there would be needed an extension of only some 1,200 feet additional to reach the present 26-foot contour line, and through this 1,200 feet the depth of dredging would decrease from about 6 feet to 0. The outer shoal has on the north side of the channel a depth of about 11 feet, while to the south is a large area with 23 feet over it. The outermost shoal, where is the bell buoy, has about 20 feet over it. But through both of these shoals the channel is already dredged to 21 feet, and more. Within the jetties there are few stretches where a central depth less than 26 feet is not already to be found; but of course there would be required a large additional amount of dredging to secure the full depth over a width of 300 feet.

A vessel properly engined and equipped to dredge 4,000 cubic yards a day in ordinary weather could be built for $150,000 probably, and true economy would call for two such craft. An output of double that of the present dredge would be 800,000 cubic yards per annum, and with two such operating 1,600,000 cubic yards removed would certainly complete the entire channel in three years' time at a total cost of $420,000. The annual cost of the dredge proposed would be about $45,000. The estimated amount of material to be dredged, measured in place, to secure a channel 300 feet wide from the 26-foot curve of the ocean to the same line in the harbor is 1,038,490 cubic yards, and for a channel 600 feet wide 2,669,837 cubic yards.

Undoubtedly the action of the tidal currents would cause such a continuous movement of material during the process of dredging that a large amount additional to the above would be carried into the channel while the dredges were working and increase the total dredging. This amount can not be estimated, but by examining the profiles showing scour it will be seen that there is a constant rolling, moving forward of sand that must be provided for. Assuming that this will add as much more to the amount to be dredged, we shall see that the estimate of three years with two powerful machines will probably cover it all.

The channel once formed must be preserved. Personally, I am of the opinion that the easiest way to do this is to continue the use of one dredge, and that this will suffice. We are now maintaining and extending a channel that is well beyond the ends of the jetties by the use of one small dredge. Although not able to work in heavy weather, it was found practicable to remove 183,429 cubic yards of material from the outer bar during 1897–98. The channel under discussion would require not more than a quarter of a mile farther seaward of this exposed work, and there is reason to believe the greater depth to be secured would cause it to be safer from filling up from storms than the channel now forming.

Gales have apparently no effect upon the jetty channel, or upon its extension, and thus far no filling up is known to have occurred from storms. Once a deepening is secured in the line of the jetty channel the currents keep it open, except in the case of two or more spots where material coming from within causes a shoal that tends to move outward. No marked damage is known to the outer channel to have occurred after any deepening.

In order to give additional ebb scour, especially after storms and spring tides, I deem it desirable to raise the inner ends of both jetties to high-water level. Whatever reasons existed for holding these ends down, they would not obtain in case the proposed channel is to be secured.

To raise the inner end of the north jetty to high-water level would require 100,466 tons, of 2,000 pounds each, which could be placed at $2 per ton..	$200, 932
For the south jetty, 233,763 tons, at $2 per ton	467, 526
	668, 458
For dredges and operating three years	420, 000
	1, 088, 458

To accomplish results for these figures it is expected that the sum estimated would be appropriated in such manner as to be available as soon as needed.

There are those who think that a dredged channel such as indicated will not be preserved unless the jetties be extended. The following is submitted as an estimate for such extension. It is based on the idea that a foundation course of rock, weighing between 1 and 3 tons each, shall be laid about 100 feet wide from the present end of each jetty to the 26-foot contour line. For the north jetty this will be an extension of 4,830 feet, and for the south jetty of 5,840 feet. On the foundation will be built up a central ridge, 20 feet wide on top, with natural slopes, of rock of the same description. The crest will be carried to high-water level, except for the outer half mile, which will be allowed gradually to slope to the outer end. This gentle slope will prevent any development of extraordinary wave action at the outer ends of the jetties. The estimate for this jetty extension is:

North jetty, 4,830 feet; 239,951 tons, at $2 per ton	$479, 902
South jetty, 5,840 feet; 360,092 tons, at $2 per ton	720, 184
	1, 200, 086
Add, for office expenses and contingencies, 10 per cent	120, 008
	1, 320, 094
Adding this to prior estimate of	1, 088, 458
Total	2, 408, 552

There are inclosed illustrative charts showing jetty action and profile changes, and a chart giving the results of a survey just finished of the seaward areas beyond the jetties. These will complete the plans and estimates required.

As to the advisability of this extension, there are two ways of looking at it. The commercial records of Charleston Harbor indicate a large falling off in foreign business in recent years. Considering only foreign arrivals and clearances, for seven years past we have—

Year.	Arrivals.		Clearances.	
	Number.	Tons.	Number.	Tons.
1891	177	123,864	196	150,295
1892	115	74,229	139	95,150
1893	136	99,154	129	94,182
1894	122	104,978	112	103,191
1895	78	57,235	85	83,703
1896	96	82,622	73	75,703
1897	117	186,981	84	89,769

Possibly there is a tendency to improve since the deeper channel was secured. A large vessel has entered and left this harbor this summer drawing 24 feet, and this draft would undoubtedly accommodate all coastwise business. The largest cargo of cotton taken out was somewhere near 13,000 bales. Yet I read to-day that the British steamer *Monarch* left New Orleans in the week of November 7–12 with a cargo equal to about 27,500 bales of cotton. Of course this was only possible because of the great draft permissible, all due to the jetty channel. Would such a vessel come here if it could? It certainly would not come until such draft were secured, when by going to New Orleans a cargo more than double that possible here could be got there. Cheap ocean freights are got only in large vessels where are deep-draft harbors.

From a military and naval point of view it is certain that this harbor should be made accessible to our largest vessels. Lying within an hour's run of the sea the wharves of Charleston are of great value when a prompt exit or entrance is desirable from any reason for army or navy purposes. When the Navy builds and Congress approves of the building of a ship of war costing $4,000,000 and drawing 27 feet, it would seem to be undoubted wisdom to spend half of her value if that expense would make a harbor that could be entered in case of storm or when supplies or slight repairs were needed. Once during this summer a transport lay off this harbor for days, and troops were taken to it by small steamers. I do not hesitate to state that I think an expenditure of $1,500,000, which would make this harbor accessible to our men-of-war within three years' time, is highly advisable.

Very respectfully,

E. H. RUFFNER,
Major of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., December 2, 1898.

Respectfully submitted to the Chief of Engineers, United States Army.

* * * * * * *

My opinion is, that by an extension of the jetties, supplemented by dredging, a channel 26 feet deep can be formed, but its maintenance will require constant dredging for a term of years, at least.

It is not impossible, however, that a channel 26 feet deep can be made and maintained by dredging alone, provided the capacity of the dredges is sufficient to remove not less than 1,000,000 cubic yards annually. One large dredge, in addition to the one now on hand, could remove this amount of material. If it be found, however, that such dredged channel could not be maintained by dredging alone, then the jetties should be extended.

The raising of the inner ends of the jetties to the level of high water is, in my opinion, decidedly objectionable, and should not be undertaken. * * *

In order to secure a channel 26 feet deep at mean low tide, which I consider advisable, my recommendation would be to build a large seagoing dredge of a capacity of not less than 4,000 cubic yards per day and work it in conjunction with the dredge now on hand. Such a dredge would cost, say, $150,000, and $45,000 per annum to run it, or a total appropriation of $285,000 to build such a dredge and operate it for three years. If at the end of that time it was found that the depth of 26 feet could not be maintained, the jetties could be extended.

I understand there is still on hand enough of the old appropriation to run the dredge now there about three years more.

Peter C. Hains,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

APPENDIX O.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. **Savannah Harbor, Georgia.**
2. **Savannah River, Georgia.**
3. **Savannah River, above Augusta, Georgia.**
4. **Doboy Bar, Georgia.**
5. **Darien Harbor, Georgia.**
6. **Altamaha River, Georgia.**
7. **Oconee River, Georgia.**
8. **Ocmulgee River, Georgia.**
9. **Brunswick Harbor, Georgia.**
10. **Inside water route between Savannah, Georgia, and Fernandina, Florida.**
11. **Removing sunken vessels or craft obstructing or endangering navigation.**

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., July 24, 1899.

GENERAL: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1899, upon the works of the river and harbor improvements in my charge.

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

O 1.

IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA.

Savannah Harbor proper is formed by the navigable part of the tidal portion of Savannah River lying within and below the limits of the city of Savannah—that is, Front River and North Channel from Central Railroad pier down to the sea. In a wider sense of the word the term Savannah Harbor comprises both branches of the river—that is, Front River, North Channel, and Back River, South Channel, from Cross Tides down to the sea.

ORIGINAL CONDITION.

In 1873, before the work of improvement was inaugurated, the usual draft of vessels navigating the river at high water was 14.5 feet. The mean rise and fall of the tide was about 6.5 feet at the city of Savannah and 7 feet at the mouth of the river.

PLAN OF IMPROVEMENT.

The original plan for the improvement of Savannah Harbor is dated August 28, 1873; that was supplemented by the project of March 19, 1879, and both of those projects were replaced by the third or enlarged project of January 16, 1882, which is given in Appendix J 4, Annual Report of the Chief of Engineers for that year, where also the earlier projects are outlined.

On July 22, 1890, a project was adopted providing for a mean high-water depth of 26 feet from the city to the sea. This project is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The work contemplated by it was reported complete at the end of the fiscal year 1896, and during the next fiscal year only repair work and a small amount of dredging was carried on in accordance with it.

There was submitted on December 7, 1894, a modified plan of improvement, providing for a detached extension of the Oyster Bed training-wall for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll, against the destructive action of heavy storms. This project, which was printed as part of Appendix M 1, Annual Report of the Chief of Engineers for 1895, was authorized by law of June 3, 1896, and is now in force.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

A detailed summary of the jetty work done prior to June 30, 1890, is given in my predecessor's report for 1891 (Report of the Chief of Engineers for 1891, p. 1492 and following). A summary of obstructions removed and of dredging done during the same period will be found in his report for 1896 (Report of the Chief of Engineers for 1896, p. 1213).

A summary of the jetty work and the dredging done under the new project from July 1, 1890, to June 30, 1896, will be found in my predecessor's report for 1896 (Report of the Chief of Engineers for 1896, pp. 1218–1220), and in the same officer's report for 1897 (Report of the Chief of Engineers for 1897, pp. 1495 and 1496).

Up to July 1, 1896, the total expenditure for the work under the project of 1890 amounted to $3,460,049.99.

Under the continuation of this project, approved by act of Congress June 3, 1896, there had been expended up to June 30, 1898, $367,664.58, making a total expenditure under the project of 1890 and its continuation of $3,827,714.57. There had been previously expended $1,401,097.91, making a total expenditure on this work from 1873 to June 30, 1898, of $5,328,812.48.

CONDITION OF WORK JUNE 30, 1898.

No dredging was done in Savannah Harbor between July, 1896, and January 11, 1897.

On the above date the least practicable channel depths, at mean low water, was as follows: In the upper half of Marsh Island Channel, 12 feet; in the lower half of that channel, 18 feet; Garden Bank, 18½ feet; Wrecks Channel, 19 feet; Obstructions Channel, 19 feet; Upper Flats, 18½ feet; Long Island Crossing, 17½ feet.

The training walls had not apparently deteriorated since the time of their reported completion.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

The Atlantic Contracting Company has done no work during the fiscal year under their contract of October 8, 1896, for jetty work.

Dredging, under contract of October 6, 1896, with Rittenhouse R. Moore, was continued through the fiscal year. The following quantities of material were removed:

	Cubic yards.
Marsh Island Channel	174,581.8
City Front	28,812.1
Lower Flats	20,775.2
Long Island Crossing	66,767.7
Upper Flats	13,377.0
Wrecks Channel	54,507.4
Obstructions Channel	68,928.2
Total	427,749.4

The material at Marsh Island Channel was pumped ashore behind the Marsh Island training wall.

Day marks and observation stations were repaired and rebuilt.

CONDITION OF WORK JUNE 30, 1899.

The improvement of this harbor consists of training walls, built mostly of bundles of brush, with a light load of porous limestone. Their position is shown on map published opposite, page 1,244 of the Report of the Chief of Engineers for 1896. In the upper portion of the harbor the training walls are of small width and are held in shape by parallel rows of piling. At the lower end of the harbor the walls are much wider and the brush is made into mattresses, the foundation being about 100 feet wide. During and after construction these mattresses settled materially and the walls were built up to mean low water by a narrow ridge of limestone. A recent examination shows that the removal during the year of 427,000 cubic yards of material did not restore the channel to its reported depth in July, 1896. At the close of the present fiscal year the shoalest place in the lower harbor was at Long Island Crossing, where there was only 17½ feet at mean low water. Opposite the ocean steamship wharves there is a shoal with 15 feet only, and just below the city exchange a shoal with 16 feet at mean low water. During the year many vessels have been aground in the harbor. The United States transport *Chester*, drawing 24 to 25 feet, was aground several times. On two occasions she had to be dredged out. The steamer *Teviotdale*, drawing 24 feet 6 inches, went aground in the channel and was strained and badly damaged.

The training walls are about 600 feet apart at the upper end, above the city, gradually widening to 2,400 feet opposite Tybee Island. They are built, theoretically, to mean low water and were expected to assist in the formation of the channel by increased scour and to maintain such channel when once formed. They apparently were not successful in the first, since, in the formation of the navigable channel, under the project of 1890, 6,036,699.16 cubic yards of material were excavated by dredging, enough apparently to cause the resulting channel entirely without any assistance from the training walls. The amount of material excavated since the completion of the channel to maintain it, together with the amount now in the channel, as shown by a recent examination, indicates that the channel is filling in at the rate of about 365,000 cubic yards per year, which at present prices will require about

$47,000 per year for its removal. From the quantity of this deposit and the localities in which it occurs it would appear that the bulk of the material brought down by the Savannah River is deposited between the training walls, where it will have to be ultimately dredged out, and that the training walls are therefore of comparatively little assistance in maintaining the channel. They possibly cause a more uniform distribution of the material, so that dredging is saved by the amount of permissible fill in places that were previously of unnecessary depth. The above examination, however, indicates that while the deep holes have moved downstream they have not filled up to any great extent and that shoaling is taking place at every point where shoals obstructed navigation at the beginning of the improvement. The greatest shoaling is at the lower end of Long Island Crossing, about where the mud brought down in suspension meets sufficient salt water to precipitate it.

Theoretically the training walls appear to be correctly located and should maintain the channel. Their failure to do so is probably due to their lack of height. In many places they are not effective up as high as low-water mark, their crests being mostly about 6 inches below low water, quite extensive stretches being from 1½ to 2½ feet below low water. To raise them would cost a large amount; but, on the other hand, if present indications continue, the necessary annual dredging to maintain the channel will also constitute a heavy expense. Possibly the rate of fill may decrease. A careful survey about a year from now, to compare with the survey of 1896, should give reliable information on this point.

COMMERCE AND NAVIGATION.

Full discussions of the commerce of Savannah were given in the Reports of the Chief of Engineers for 1890, pages 1252 and 1253, and for 1897, page 1497.

The regular lines of steamships established between this port and New York, Boston, and Baltimore comprise a total of 14 steamers, of which 8 run to the first-named two ports and 6 to the last-named one. During the last calendar year they made 376 voyages and carried 520,873 tons of freight.

On the inland waters there are a number of small steamers plying between Savannah and adjacent ports, making annually from 500 to 600 trips and carrying about 67,000 tons of freight, valued at about $4,000,000.

The chief articles of export are cotton, lumber, and naval stores, of which the present annual shipments may be given in round numbers as follows: Of cotton, 1,190,065 bales; of lumber, 140,761,882 feet, and of naval stores, 342,643 barrels of turpentine and 1,151,229 barrels of rosin.

Besides this, about 35,000 troops were handled through the port during the war with Spain, and transports, making something over 65 round trips, entered and left the harbor, carrying a great amount of quartermaster supplies and munitions of war.

The total tonnage of the port, inward and outward bound, during 1898, was 1,500,000 tons.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1898, $36,907.33. The nearest light-houses are those upon the river, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

The total expenditures under the present project up to June, 1899, amounted to $440,435.67.

Money statement.

July 1, 1898, balance unexpended		$481, 820. 48
Amount appropriated by sundry civil act approved March 3, 1899		200, 000. 00
Amount appropriated by river and harbor act approved March 3, 1899		50, 000. 00
Amount deposited		299. 66
		732, 120. 14
June 30, 1899, amount expended during fiscal year		72, 771. 09
July 1, 1899, balance unexpended		659, 349. 05
July 1, 1899, outstanding liabilities	$86, 721. 78	
July 1, 1899, amount covered by uncompleted contracts	469, 169. 52	
		555, 891. 30
July 1, 1899, balance available		103, 457. 75
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement		50, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNT AND DATE OF ALL APPROPRIATIONS.

From 1826 up to the date of the 22-foot plan of improvement appropriations amounting to $667,096.64 were made for the improvement of the harbor and for the removal of wrecks, as follows:

By act of Congress of—		By act of Congress of—	
March 18, 1826	$50, 000. 00	August 30, 1852	$40, 000. 00
March 3, 1829	24, 490. 00	March 3, 1855	161, 000. 00
July 3, 1832	25, 000. 00	June 10, 1872	50, 000. 00
March 2, 1833	43. 06	March 3, 1873	50, 000. 00
March 2, 1833	8, 430. 62	February 27, 1874	193, 132, 96
June 28, 1834	30, 000. 00		
March 3, 1835	20, 000. 00	Total	667, 096. 64
July 7, 1838	15, 000. 00		

Under the 22-foot plan of improvement the following appropriations were made:

By act of Congress of—		By act of Congress of—	
June 23, 1874	$50, 000. 00	August 5, 1886	$150, 000. 00
March 3, 1875	70, 000. 00	August 11, 1888	180, 000. 00
August 14, 1876	62, 000. 00		
June 18, 1878	70, 000. 00		1, 212, 000. 00
March 1, 1879	100, 000. 00	Unexpended balance of last appropriation carried to new project	4, 035. 05
June 14, 1880	65, 000. 00		
March 3, 1881	65, 000. 00		
August 2, 1882	200, 000. 00		
July 5, 1884	200, 000. 00	Total	1, 207, 964. 95

Under the 26-foot plan of improvement the following appropriations have been made:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$4, 035. 05
September 19, 1890	350, 000. 00
July 13, 1892	318, 750. 00
March 3, 1893	1, 000, 000. 00
August 18, 1894	975, 000. 00
March 2, 1895	856, 250. 00
	3, 504, 035. 05
Amount deposited by clerk of United States circuit court for the southern district of Georgia, March 20, 1895	500. 00
	3, 504, 535. 05
Unexpended balance of last appropriation carried to modified project	44, 485. 06
Total	3, 460, 049. 99

Since the existing project for improving Savannah Harbor was adopted the following appropriations have been made:

By act of Congress of—		
March 2, 1895 (unexpended balance)		$44,485.06
June 3, 1896		5,000.00
June 4, 1897		350,000.00
July 1, 1898		450,000.00
March 3, 1899	$200,000.00	
	50,000.00	
		250,000.00
		1,099,485.06
Amounts deposited to the credit of the appropriation		299.66
Total		1,099,784.72
Grand total of appropriations		6,434,896.30

Abstract of bids opened at Savannah, Ga., September 8, 1896, by Capt. O. M. Carter, Corps of Engineers, for improving harbor at Savannah, Ga.

No.	Name and address of bidder.	Mattresses (200,000 sq. yds.).		First-class stone (25,000 tons).		Second-class stone (25,000 tons).	
		Price.	Amount.	Price.	Amount.	Price.	Amount.
2	P. Sanford Ross, Jersey City, N. J.	$0.90	$180,000	$4.80	$120,000	$4.80	$120,000
5	The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y. *a*.	.95	190,000	3.90	97,500	3.90	97,500
7	John L. Grim, Philadelphia, Pa.	.98	196,000	4.00	100,000	4.00	100,000

No.	Name and address of bidder.	Third-class stone (50,000 cubic yards).		Fourth-class stone (100,000 cubic yards).		Total for jetty work.	Dredging 1,250,000 cubic yards.	
		Price.	Amount.	Price.	Amount.		Price.	Amount.
1	Virginia Dredging Co., J. Clements Shafer, secretary and treasurer, Richmond, Va. *b*	......	....	......	....	....	$0.16 9/10	$211,500
2	P. Sanford Ross, Jersey City, N. J.	$3.55	$177,500	$2.60	$260,000	$857,500	.17 9/10	223,750
3	Savannah Dredging Co., Jacob Paulsen, president, Savannah, Ga.	......	....	......	....	....	.20½	256,250
4	American Dredging Co., S. Y. Schermerhorn, president, Philadelphia, Pa. *c*	......	....	......	....	....	.22	275,000
5	The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y. *c*	3.50	175,000	2.75	275,000	835,000	......	....
6	Rittenhouse R. Moore, Mobile, Ala. *a*	......	....	......	....	....	.13	162,500
7	John L. Grim, Philadelphia, Pa.	3.30	165,000	2.90	290,000	851,000	......	....

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a It is recommended that the bid of the Atlantic Contracting Company, of New York, John F. Gaynor, president, for jetty work (the first five items), and of Rittenhouse R. Moore, of Mobile, Ala., for dredging (item 6), be accepted, they being the lowest responsible bidders for the best and most suitable materials and service.

b Bond of $50,000 submitted instead of $250,000, as required.

c Evidence of authority to bid not filed.

Remarks.—Amount for which the Secretary of War is authorized to enter into contracts, $1,005,000.

List of contracts in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
Rittenhouse R. Moore, Mobile, Ala.	Dredging	Oct. 28, 1896	Jan. 12, 1897	On or before the expiration of one year after the total sum of money for which the Secretary of War is authorized to enter into contract under these specifications shall have been appropriated.
The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y.	Jetty	Oct. 27, 1896	Dec. 8, 1896	

COMMERCIAL STATISTICS.

Cotton statistics of the port of Savannah, Ga., for the commercial year ending August 31, 1898, are as follows:

Receipts from all sources.

Grade.	Quantity.	Weight.	Value.
	Bales.	*Pounds.*	
Upland	1,132,818	564,041,410	$33,157,582
Sea-island	59,239	23,080,106	3,505,171
Total	1,192,057	587,121,516	36,662,753

Exports from Savannah.

Destination.	Upland.	Sea-island.
	Bales.	*Bales.*
Coastwise	411,991	44,128
Great Britain	61,535	12,205
France	31,118	1,429
Other continental ports	625,854	1,805
Mill consumption and burned		55
Reshipped to interior	516	
Total	1,131,014	59,622

Total exports.

Grade.	Foreign exports.	Coastwise exports.	Total.
	Bales.	*Bales.*	*Bales.*
Upland	718,507	411,991	1,130,498
Sea-island	15,439	44,128	59,567
Total	733,946	456,119	1,190,065

Steamship lines.

Line.	Steamers.	Voyages.	Freight.
Ocean Steamship Co.:			*Tons.*
Savannah to New York	6	210	267,096
Savannah to Boston	2	56	57,576
Merchants and Miners Transportation Co.:			
Savannah to Baltimore	6	110	196,201
Total	14	376	520,873

Cotton receipts at Savannah from 1872 to 1898.

Season August 31 to September 1.	Quantity.	Season August 31 to September 1.	Quantity.
	Bales.		*Bales.*
1872-73	612,794	1885-86	808,359
1873-74	630,372	1886-87	804,412
1874-75	614,478	1887-88	892,318
1875-76	523,244	1888-89	828,163
1876-77	477,435	1889-90	956,517
1877-78	597,449	1890-91	1,139,560
1878-79	698,764	1891-92	1,027,816
1879-80	741,018	1892-93	793,808
1880-81	889,383	1893-94	971,405
1881-82	737,056	1894-95	946,272
1882-83	817,760	1895-96	784,963
1883-84	655,749	1896-97	846,591
1884-85	728,087	1897-98	1,192,057

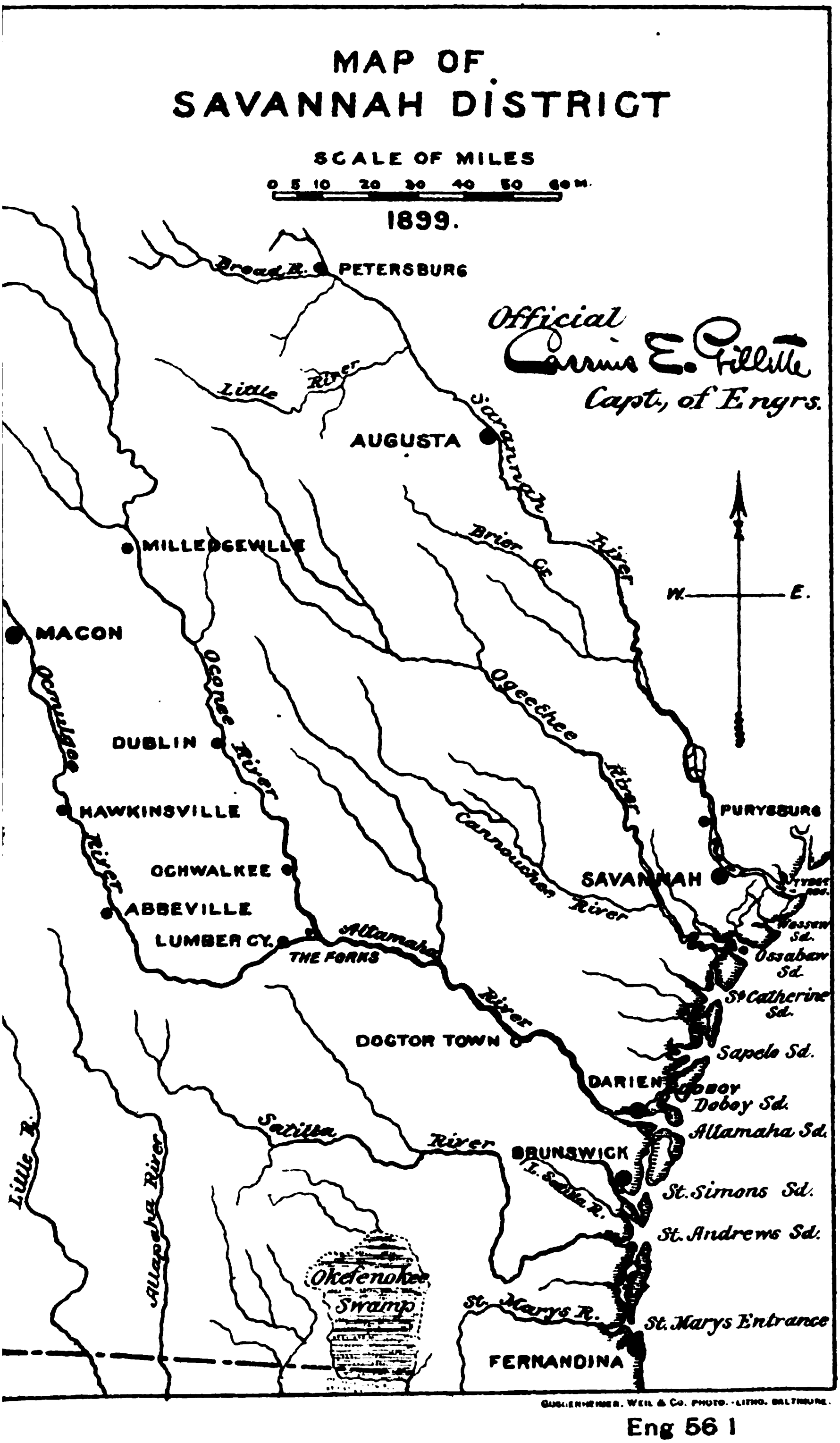
Receipts of naval stores at the port of Savannah from April 1, 1883.

Season.	Spirits turpentine.	Rosin.
	Casks.	*Barrels.*
1883-84	133,139	564,026
1884-85	117,291	478,834
1885-86	107,369	450,106
1886-87	147,352	582,539
1887-88	169,961	643,532
1888-89	158,208	584,428
1889-90	183,558	683,077
1890-91	196,166	758,448
1891-92	234,986	873,678
1892-93	277,617	1,032,198
1893-94	261,080	957,020
1894-95	268,259	993,164
1895-96	303,867	1,143,026
1896-97	329,445	1,311,060
1897-98	313,797	1,127,120
1898-99	329,466	1,123,942

Arrival and clearance of vessels and commerce at Savannah, Ga., from January 1, 1873, to December 31, 1898.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1873	463	381,595	11,934	34	16,140	383	213	119,816	2,999	710	517,061	15,316	17.50
1874	418	354,700	10,048	66	41,030	487	284	182,517	4,232	768	578,247	15,127	17.50
1875	370	310,887	10,102	67	39,832	781	222	145,748	3,290	659	495,923	14,173	17.50
1876	355	320,015	10,348	58	40,298	987	260	160,640	3,865	673	530,496	15,200	17.75
1877	333	379,826	10,867	54	40,948	951	287	168,247	3,950	674	589,021	15,768	18.25
1878	322	385,532	10,688	61	45,208	576	326	235,787	5,814	709	666,527	18,078	18.50
1879	319	414,794	8,235	30	21,994	1,576	279	198,040	3,960	628	634,828	12,634	17.75
1880	338	446,881	9,996	14	7,724	439	244	172,224	3,533	596	626,829	13,699	18.33
1881	382	508,422	11,069	21	10,729	170	254	151,463	3,474	658	670,614	14,780	19.00
1882	391	544,488	12,605	11	4,865	237	204	115,061	2,718	606	666,374	16,429	19.00
1883	380	468,226	10,659	10	4,115	106	160	87,020	1,965	550	559,366	12,714	18.25
1884	388	482,917	13,735	14	5,632	90	287	174,676	3,984	689	663,225	17,835	19.00
1885	395	493,610	14,622	12	5,058	116	251	163,321	3,416	658	668,989	18,163	20.75
1886	393	503,073	14,534	10	5,952	125	268	177,229	3,719	671	686,254	18,438	20.00
1887	430	543,235	15,127	8	2,725	185	231	130,136	2,800	669	676,096	17,987	20.40
1888	411	539,576	14,907	8	3,560	60	229	146,075	3,288	648	689,211	18,306	20.67
1889	409	561,463	15,547	12	6,563	111	309	215,865	4,530	730	783,891	20,231	20.70
1890	483	717,561	19,178	9	2,303	69	300	193,263	4,058	792	913,217	23,305	20.00
1891	484	719,328	19,014	13	4,778	123	325	238,123	4,790	822	962,229	20,927	20.00
1892	449	692,726	18,345	6	3,000	51	358	259,482	5,228	813	955,208	23,624	20.00
1893	445	667,848	16,970	7	2,761	59	330	255,632	4,796	775	923,480	21,946	22.12
1894	445	691,603	17,354	6	3,877	58	258	222,383	4,152	709	917,863	21,564	......
1895	467	732,707	18,045	5	3,680	46	235	204,177	3,598	707	940,564	21,689	20.07
1896	421	697,577	17,502	7	4,884	58	269	253,754	4,359	697	956,215	21,919	22.50
1897	442	734,716	18,655	8	4,236	153	297	315,120	5,242	747	1,054,072	24,050	23.50
1898	423	700,681	17,665	8	4,820	143	307	316,411	5,229	738	1,021,912	23,037	24.00



MAP OF SAVANNAH DISTRICT

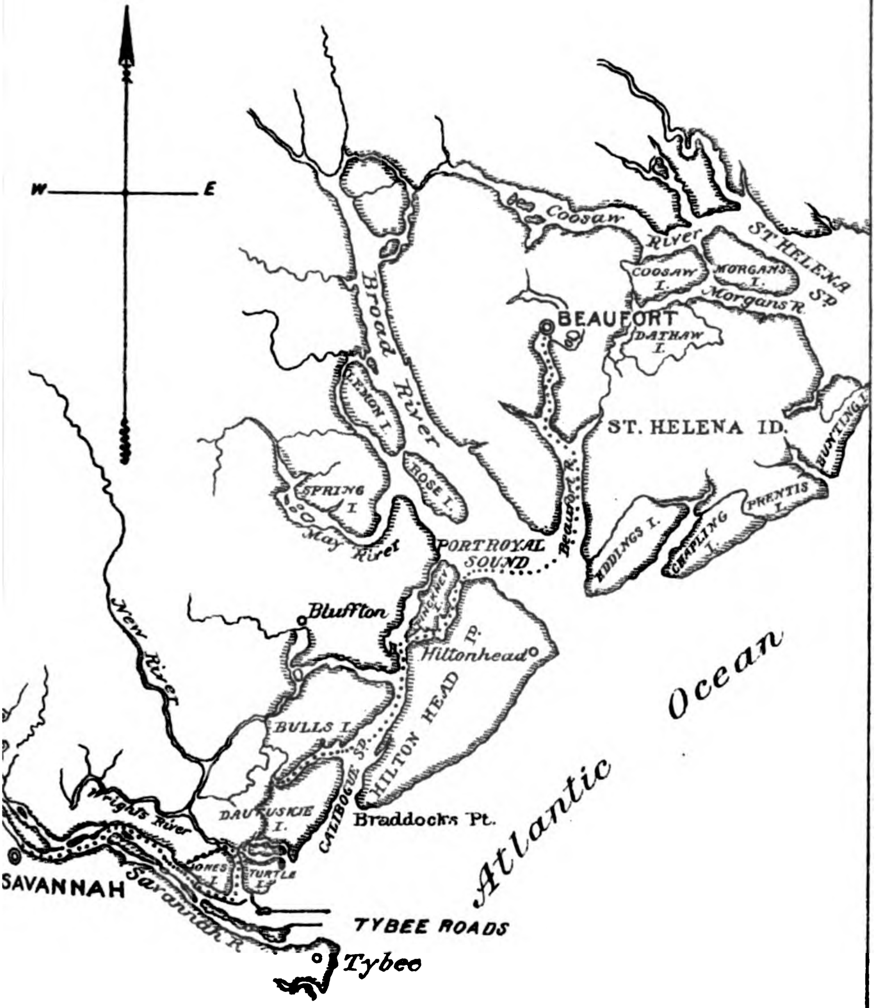
SCALE OF MILES

1899.

Official
Cassius E. Gillette
Capt. of Engrs.

GUGGENHEIMER, WEIL & CO. PHOTO.-LITHO. BALTIMORE.

Eng 56 1



MAP OF
INSIDE ROUTE
SAVANNAH TO BEAUFORT

SCALE OF MILES

10 M. 5 0 10 M.

1899

Official: Cassius E. Gillette

Capt., of Engrs.

GUGGENHEIMER, WEIL & CO. PHOTO.-LITHO. BALTIMORE.

Eng 56 I

Arrival and clearance of vessels and commerce at Savannah, Ga., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1873 ..	466	398,050	13,749	65	30,102	669	224	129,164	3,194	755	557,316	17,632	17.50
1874 ..	480	407,295	12,748	71	40,397	822	229	145,038	3,437	780	592,730	17,007	17.50
1875 ..	319	234,831	9,376	72	39,311	804	195	128,086	2,924	586	452,228	13,404	17.50
1876 ..	410	361,999	11,222	80	49,483	1,163	185	119,699	2,827	675	531,781	15,212	17.75
1877 ..	400	439,370	12,081	65	44,829	1,066	161	103,342	2,489	626	587,541	15,736	18.25
1878 ..	378	418,958	10,475	64	40,128	1,255	260	183,757	5,375	702	642,843	17,105	18.50
1879 ..	365	442,734	8,834	36	24,891	497	223	156,470	3,129	624	624,095	12,460	17.75
1880 ..	310	434,864	10,108	26	12,536	271	242	168,255	3,446	578	615,655	13,825	18.33
1881 ..	369	508,422	11,458	22	13,052	253	261	180,579	3,745	652	702,053	15,456	19.00
1882 ..	350	506,213	11,917	23	9,155	205	209	135,375	3,023	582	650,743	15,145	19.00
1883 ..	355	415,720	9,780	10	4,115	90	165	87,400	2,015	530	507,235	11,885	18.35
1884 ..	360	452,802	13,363	15	5,634	131	285	194,075	4,315	663	652,411	17,809	19.00
1885 ..	414	502,773	14,672	20	8,722	148	228	154,858	3,344	662	666,353	18,164	20.17
1886 ..	378	473,134	13,912	3	939	24	262	194,793	3,970	643	668,867	17,906	20.00
1887 ..	380	480,030	14,167	4	678	29	269	202,656	4,186	653	683,364	18,382	20.00
1888 ..	382	507,075	14,231	8	2,583	63	233	167,836	3,557	623	677,494	17,851	....
1889 ..	395	540,293	15,505	7	1,323	51	307	226,181	4,601	711	767,747	20,157	....
1890 ..	452	663,227	18,815	14	4,087	161	323	248,013	5,078	789	913,327	24,054	20.75
1891 ..	445	676,900	18,200	4	9,909	208	339	271,067	5,429	788	957,876	23,837	20.75
1892 ..	453	685,620	18,235	7	1,766	48	353	263,166	5,151	813	950,252	23,484	21.60
1893 ..	411	622,381	16,190	9	4,059	75	338	282,680	5,524	749	905,061	21,714	21.75
1894 ..	403	636,202	16,425	4	1,555	32	311	289,882	5,155	718	927,639	21,612	22.50
1895 ..	412	643,303	16,642	2	718	21	297	303,534	5,220	711	947,555	21,883	23.02
1896 ..	366	623,966	16,293	6	2,763	57	311	315,615	5,310	683	942,344	21,660	23.60
1897 ..	386	668,946	17,680	6	2,534	55	338	373,714	6,137	730	1,045,194	23,872	24.00
1898 ..	387	648,365	16,902	7	3,552	60	326	353,326	5,731	720	1,005,243	22,693	25.00

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.	Year.	Value of exports.	Value of imports.	Duties collected.
1877.........	$32,103,853	$36,307,908	$34,959.93	1888........	$56,435,601	$53,412,920	$98,213.75
1878.........	40,028,988	42,948,465	23,364.35	1889........	62,892,429	55,062,710	58,815.54
1879.........	40,901,421	43,064,472	27,778.73	1890........	84,584,326	68,229,825	57,542.57
1880.........	47,836,411	45,522,480	78,458.41	1891........	83,367,157	67,248,000	56,714.50
1881.........	58,985,901	48,716,900	356,550.22	1892........	67,211,175	54,119,194	47,687.00
1882.........	52,004,248	45,952,105	61,148.70	1893*a*	23,535,503	450,378	56,664.90
1883.........	53,915,934	47,699,796	65,245.34	1894*a*	21,374,516	372,525	47,616.67
1884.........	46,425,513	49,112,316	49,147.28	1895*a*	21,690,283	273,305	58,582.49
1885.........	48,313,216	49,313,216	45,161.40	1896*a*	22,689,611	349,237	36,149.81
1886.........	51,033,190	51,118,524	35,455.53	1897*a*	28,937,655	379,089	46,697.24
1887.........	54,774,082	52,659,223	48,837.12	1898*a*	26,342,891	362,825	36,907.33

a Foreign only.

JOHN H. DEVEAUX,
Collector of Customs.

MAPS ACCOMPANYING THIS REPORT.

1. Map showing Savannah, Ga., district.
2. Map showing inside route from Savannah, Ga., to Beaufort, S. C.

O 2.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA.

Appropriations under this title have been for that portion of the river between Augusta, Ga., and Savannah, Ga.

A detailed description of the river is found in House Ex. Doc. No. 213, Fifty-first Congress, first session, and in Appendix O 2, Annual Report of the Chief of Engineers for 1890, pages 1328 and 1363.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 4 to 5 feet of water; but during the low-water season there are various shoals in the upper part of the river with low-water depths of less than 3 feet. The chief obstruction to navigation consists of sand and gravel bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving the Savannah River was submitted in 1880, and is given in Appendix J of the Annual Report of the Chief of Engineers for 1881.

The revised plan of improvement, as outlined in the Report of the Chief of Engineers for 1890, page 1328, provides for the establishment of a navigable channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah.

This is to be accomplished by (1) removing sand and gravel bars; (2) regulating portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated, in round numbers, at $332,000, provided funds are regularly and adequately supplied.

From $3,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a summary of the work done under the original project of improvement, see page 1520 of the Annual Report of the Chief of Engineers for 1891; for a summary of the work done under the revised plan of improvement from 1891 to 1897, see pages 1503 and 1504 of the same report for 1897.

The total expenditure under the present project up to June 30, 1898, was $82,976.23; expended under previous projects, $93,480.09; making a total of $176,456.32.

CONDITION OF WORK JUNE 30, 1898.

The project for this river calls for a depth of 5 feet at mean low water. Considerable work has been done, but almost no progress made toward attaining the desired result. For the first 18 miles below Augusta there are numerous shoals having only about 3 feet of water, and the shoals near Brighams Landing and Flowery Gap, about 50 miles farther down the river, have about the same depth. A number of spur dams have been built near Augusta, but they have not accomplished much, and two of them are in the way of steamboats and will have to be removed. Various types of spur dams for shore protection in this vicinity where banks are caving have been built without results. Spur dams immediately below Augusta, built under contract with W. T. Gaynor and John F. Gaynor in 1889 and 1893, have practically disappeared. Those built and rebuilt in 1893 under contract with A. J. Twiggs are still standing in about the same condition as when built and have caused some deepening of the channel. Shore-protection spurs consisting of piling with brush wattling, built by hired labor in 1894 to stop the caving bank near Canoe Cut Bar, have proved totally ineffective, and the spurs themselves are wrecks.

The channel at the above date was fairly free from snags, but such condition is only temporary, as snags form constantly.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Snagging operations were commenced by the snag boat *Toccoa* on May 29, 1899, and continued until June 7, 1899, when she was burned to the water's edge. The boat was very old and of little value. The snag boat *Satilla* began snagging operations on June 10, 1899, and continued until the close of the fiscal year. There were removed by both boats 133 snags, stumps, and logs and 627 overhanging trees; also 108¾ cubic yards of rock. Work on a training dike for the improvement of Brighams Bar was begun June 21, 1899, and continued until the close of the fiscal year. There were placed in the dike 260 piling, the work being done by hired labor with the use of the steam pile driver *Sapelo.*

CONDITION OF WORK JUNE 30, 1899.

No increase was made during the fiscal year in the navigable depth at low water. The numerous snags need removal.

COMMERCE AND NAVIGATION.

A detailed statement of the sources of the commerce of this river is given on page 1331 of the Annual Report of the Chief of Engineers for 1890, and on page 1504 of the same report for 1897.

During the calendar year 1898 there were four steamers engaged in the river traffic, which carried about 36,875 tons of freight, valued at $2,862,015. During the same year it is estimated that 3,000,000 feet, B. M., of timber was rafted down the river, valued at about $210,000.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1898, $36,907.33. Forts Oglethorpe, Pulaski, and Screven are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

The river and harbor act of March 3, 1899, appropriates as follows:

Improving Savannah River, between Savannah and Augusta: Continuing improvement, twenty thousand dollars: *Provided,* That a contract or contracts may be entered into by the Secretary of War for the materials and work that may be necessary to complete the existing project of improvement, namely, the project provided by the survey of eighteen hundred and ninety, and published in the Appendix to the Report of the Chief of Engineers, eighteen hundred and ninety, pages thirteen hundred and twenty-eight to thirteen hundred and sixty-three, or the required materials may be purchased and the work done otherwise than by contract, to be paid as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and fifty thousand dollars, exclusive of the amounts herein and heretofore appropriated.

It is proposed to expend the $20,000 thus made immediately available in improving the bars at Brighams Landing and at Flowery Gap. This is expected to make 5 feet at mean low water from Savannah to within 18 miles of Augusta. It is proposed at the same time to carry on general snagging operations. On account of the fact that snags are constantly forming, it is impracticable and inadvisable to make a continuing contract for work involving snagging. Also, the work of improving the channel of the river for the 18 miles below Augusta is a work that can not be done most advantageously by being entirely prescribed in advance. The results accomplished by the first portion of the work should be promptly followed up by other work designed to hold and augment the improvement obtained. To this end it is desirable to have funds continuously available, so that work required can be promptly done at the most advantageous time.

During the fiscal year of 1901 it is proposed to carry a 5-foot navigation as far toward Augusta as the economical use of the plant available will permit and the contingencies of the work justify, improving at the same time the worst shoals higher up to give immediate relief to navigation. Under this plan it is proposed, during the fiscal year ending June 30, 1901, to improve the river at Half Guinea Bar, Twiggs Bar, Canoe Cut, and Buggs Bar Reach, the work to be done by hired labor. The estimated funds required for each is as follows: Half Guinea Bar, $4,500; Twiggs Bar, $8,000; Canoe Cut Bar, $7,000; Buggs Bar Reach, $18,000.

In addition there should be made available $20,000 for the construction of a new snag boat, and $7,500 for snagging operations during the fiscal year; making a total of $65,000 which can be advantageously expended during the fiscal year.

Money statement.

July 1, 1898, balance unexpended	$7,043.68
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	27,043.68
June 30, 1899, amount expended during fiscal year	6,907.69
July 1, 1899, balance unexpended	20,135.99
July 1, 1899, outstanding liabilities	2,091.98
July 1, 1899, balance available	18,044.01
Amount (estimated) required for completion of existing project	250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	65,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improvement of the Savannah River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$15,000.00
August 2, 1882	25,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	21,000.00
	91,000.00
Unexpended balance from last appropriation, carried to new project	19.91
Total	90,980.09
Received from other appropriations for use of snag boat	2,500.00
Aggregate	93,480.09

Since the existing project for improving the Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (balance unexpended)	$19.91
September 19, 1890	25,000.00
July 13, 1892	35,000.00
August 18, 1894	15,000.00
June 3, 1896	15,000.00
March 3, 1899	20,000.00
Total	110,019.91

O 3.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GEORGIA.

The Savannah River is formed by the junction of the Tugaloo and Keowee rivers and flows in a southeasterly direction to the sea. Above the city of Augusta the river is navigable only by pole boats.

A detailed description of this river is given in House Ex. Doc. No. 213, Fifty-first Congress, first session.

ORIGINAL CONDITION.

The Savannah River above the city of Augusta has a very steep slope, and the obstacles to navigation are not only very numerous and extensive but at places quite dangerous. They consist of rock ledges, isolated bowlders, and bars of sand and gravel, with minimum low-water depths of less than 1 foot.

PLAN OF IMPROVEMENT.

The original plan of improvement is given in Appendix I of the Annual Report of the Chief of Engineers for 1879.

The revised plan of improvement, as outlined in the Report of the Chief of Engineers for 1890, page 1366, provides for the establishment, between Petersburg and the Locks, of a downstream channel 12 to 15 feet in width and navigable during ordinary summer low water (or from nine to ten months of every year) for pole boats drawing 2 feet, and of an upstream channel navigable under the same conditions for pole boats drawing 1.3 feet of water.

This is to be obtained by (1) removing logs and overhanging trees; (2) excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; (3) constructing training walls to increase flow of water through sluices. The cost of improvement is estimated at $23,000, provided the money is all made available at once, or at $33,000 if supplied in smaller amounts.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a special history of work done under the original project see page 1032 of the Annual Report of the Chief of Engineers for 1888. For a summary of the work done under the revised project see pages 1506 and 1507 of the same Report for 1897.

The total expenditures under the present project, up to June 30, 1898, was $15,770.71. There had been previously expended $39,000; making a total of $54,770.91.

CONDITION OF WORK JUNE 30, 1898.

The channel was considerably obstructed and required cleaning.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1899.

The works heretofore constructed are in fair condition. Some of the training dikes built with the rock excavated from the sluices have been damaged and part of the rock washed back into the cuts. The cuts in many cases need deepening.

COMMERCE AND NAVIGATION.

A detailed statement of the commerce tributary to this river is given in a report on the examination and survey of the river printed as House Ex. Doc. No. 213, Fifty-first Congress, first session.

The freight carried on the river consists of cotton, grain, fertilizers, and general merchandise. In 1898 it amounted to about 2,500 tons, valued at $116,000.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1898, $36,907.33. Forts Oglethorpe, Pulaski, and Screven are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

Money statement.

July 1, 1898, balance unexpended	$3,229.09
Amount appropriated by river and harbor act approved March 3, 1899	1,000.00
July 1, 1899, balance unexpended	4,229.09
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	2,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

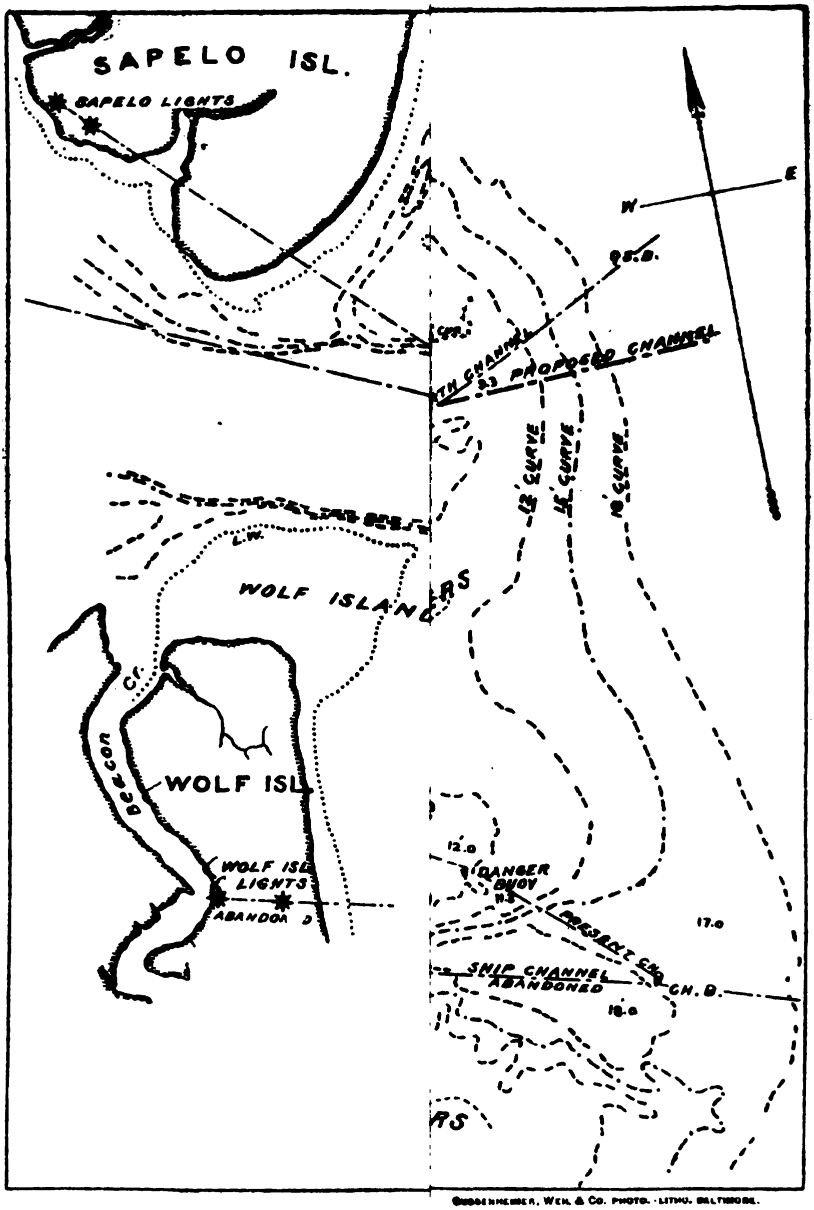
AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of Savannah River above Augusta, adopted in 1879, the following appropriations were made:

By act of Congress of—	
June 14, 1880	$16,000
March 3, 1881	8,000
August 2, 1882	15,000
Total	39,000

Since the existing project for improving this portion of Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
July 13, 1892	$10,000
August 18, 1894	6,000
June 3, 1896	3,000
March 3, 1899	1,000
Total	20,000



GUGGENHEIMER, WEIL & CO. PHOTO.-LITHO. BALTIMORE.

Eng 56 I

O 4.

IMPROVEMENT OF DOBOY BAR, GEORGIA.

The Altamaha River, with its tributaries, the Oconee and Ocmulgee, drains a heavily timbered region, and large quantities of pine timber have sought annually, for years in the past, and will, for some years to come, seek an outlet to the ocean at the mouth of the river. The river empties principally into Altamaha Sound, which is very shoal. Branches of the river, however, connect with Doboy and Sapelo sounds to the north and St. Simons Sound to the south. Practically all of the timber coming down the river passes through the town of Darien, on the branch leading to Doboy and Sapelo sounds. Some years ago this timber was shipped from Doboy Sound, the smaller vessels going to Darien, the larger ones loading near Doboy Island. The bar at the entrance to Doboy Sound has shoaled very much in recent years, so that the bulk of the timber is now shipped from Sapelo Sound, except that which goes to St. Simons Mills, near Brunswick. Sapelo Sound constitutes a fine harbor, with an easy entrance, and vessels in large numbers now load at that point, the timber being brought from Darien in rafts along the line of the inside route from Savannah to Fernandina. The haul, however, is rather a long one, and owing to lack of improvement of the inside route it is rather an inconvenient one. The distance is no greater, however, than the distance from Darien to the large mills on St. Simons Island and near Brunswick, which obtain all of their timber from the Altamaha River. The deepening of Doboy Bar will save part of the long haul on the timber that goes to Sapelo, but will have no effect on that which goes to St. Simons.

During the year 1898 about 95,000,000 feet of timber went to Sapelo and about 48,000,000 feet to St. Simons. The rosin and turpentine at present produced on the Altamaha are not shipped from Darien, but from Brunswick and Savannah.

ORIGINAL CONDITION.

In its present condition Doboy Bar, shown on the map herewith, has about 11 feet at mean low water. The rise of the tide is about 7 feet. In 1868 the bar had about 3 feet more water. In 1886 its condition was about the same as at present. The appropriation act of August 5, 1886, of $20,000 for the improvement of the Altamaha River, authorized $10,000 to be used on Doboy Bar. In accordance therewith $5,795.40 was expended in 1888 in an attempt to deepen the channel by harrowing and excavating with a water jet. No increase in depth was obtained.

PLAN OF IMPROVEMENT.

The present project calls for making a channel 300 feet wide and 24 feet deep at mean high water by dredging. It is given in House Ex. Doc. No. 13, Fifty-fifth Congress, first session, and was adopted by act of March 3, 1899, which appropriates $70,000 for doing the work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

Outside of the hydraulic excavation above referred to, no work of improvement has been done on this bar.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

To determine the present condition of the bar, an examination was made during the month of May, 1899. Preparations for dredging the prescribed channel by contract had been made. The contract had not yet been let.

COMMERCE AND NAVIGATION.

The bulk of the timber passing through Darien from the Altamaha River will probably cross Doboy Bar when the improvement is complete. When the timber is gone, which is a matter of comparatively a few years, the commerce will probably greatly decrease.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$70,000.00
June 30, 1899, amount expended during fiscal year	960.79
July 1, 1899, balance unexpended	69,039.21

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. Amount of duties collected in Brunswick in 1898, $23,080; at Darien, $6,834.15. Sapelo Light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven, Ga., are the nearest forts.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

The first appropriation was made by act of Congress of August 5, 1886, for improving the Altamaha River, Georgia, of which $5,795.40 was used on Doboy Bar. Under the existing project of improvement an appropriation of $70,000 for this work was made by act of Congress, approved March 3, 1899.

COMMERCIAL STATISTICS.

For commercial statistics see report on Darien Harbor, Georgia.

O 5.

IMPROVEMENT OF DARIEN HARBOR, GEORGIA.

About 12 miles above the town of Darien the Altamaha River divides into several branches. The northerly main branch forms the Darien River. That portion of Darien River between Darien and Doboy Sound is known as Darien Harbor. Darien Harbor is shown on map herewith.

ORIGINAL CONDITION.

Darien Harbor, in its original condition, was obstructed at seven points by shoals, on which were found minimum mean low-water depths of from 6.4 to 10.6 feet. The shoals covered a total distance of 9.7 miles. The reaches between the shoals carried depths nowhere less than 12 feet at mean low water. The mean rise and fall of the tide in the harbor is about 6.5 feet.

PLAN OF IMPROVEMENT.

Operations for improving this harbor have been carried on in accordance with a project of improvement printed as Appendix N 16, Annual Report of the Chief of Engineers for 1885. This contemplates the establishment of a navigable channel between Darien and Doboy with a minimum mean low-water depth of 12 feet, to be accomplished by dredging to a minimum depth of 12.5 feet and by the construction of wing dams at five of the shoals for maintaining the depth of the improved channel.

The estimated cost of the improvement was $170,000.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a summary of past work, see pages 1508 and 1509 of the Annual Report of the Chief of Engineers for 1897 and page 1303 of the same report for 1898.

The total expenditure under the project up to June 30, 1898, was $95,000. There had been expended under a previous project for dredging $8,000, making a total of $103,000.

CONDITION OF WORK JUNE 30, 1898.

On that date no recent examination had been made, but so far as known the channel had not deteriorated.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1899.

A recent examination of the wing dams constructed indicate that they had no particular effect in increasing the depth. They originally consisted of brush bundles held in place by waling strips without any load of rock whatever, built between a double row of piling. The brush all washed out. It was replaced with the addition of an insignificant load of rock. There is now little left but the piling. It is reported that the brush filling mostly washed out shortly after the dams were refilled. The dams were nearly all built in the year 1893, under contract with the Atlantic Contracting Company. They were refilled with brush and the balance built in 1895 under contract with William T. Gaynor. The channel needs dredging in places.

COMMERCE AND NAVIGATION.

The commerce of Darien consists principally of timber. A small product of rice and naval stores is shipped from that point. One steamer per week passes up and down the Altamaha River, but its terminus is Brunswick. A daily steamer runs to Brunswick

In 1898 the total annual trade amounted to about 250,000 tons, valued at about $2,500,000, and consisted mostly of timber.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$10,000.00
July 1, 1899, balance unexpended	10,000.00
Amount (estimated) required for completion of existing project	65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. The amount of duties collected in 1898 in Brunswick, $23,080; at Darien, $6,884.15. Sapolo Light is the nearest light-house and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

The present appropriation, made March 3, 1899, of $10,000, it is estimated, will complete the channel to the depth given in the project and for a width sufficient for navigation. This completes the project for $105,000, which is $63,000 less than the estimate. Of this $105,000 about $46,000 has been expended in wing dams, which have done very little to assist. The channel is a dredged channel. This branch of the river does not carry much sediment, and while it will probably shoal it may be expected to do so quite slowly. To provide against contingencies it would be advisable to have an appropriation of $3,000 for maintenance next year.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

The first appropriation (which was expended in dredging) was made by act of Congress of June 18, 1878, $8,000.

Under the existing project of improvement the following appropriations have been made for this work:

By act of Congress of—

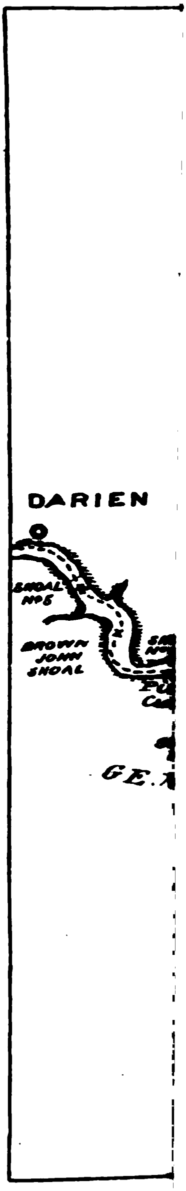
September 19, 1890	$25,000
July 13, 1892	25,000
August 18, 1894	25,000
June 3, 1896	20,000
March 3, 1899	10,000
Total	105,000
Grand total	113,000

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1, 1875, to December 31, 1898.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1875	77	28,053	647	....	......	......	92	47,600	1,198	169	75,663	1,845	22
1876	65	23,105	611	....	......	......	124	70,368	1,897	189	93,473	2,508	21
1877	104	24,827	1,257	3	674	22	99	50,913	1,231	206	106,414	2,510	20
1878	61	29,264	641	2	1,051	20	126	60,109	1,628	189	90,424	2,289	20
1879	58	23,275	487	3	4,199	25	115	57,710	1,407	176	82,184	1,919	19½
1880	66	21,539	489	1	688	13	134	68,072	1,608	201	90,270	2,140	19½
1881	101	40,619	840	3	1,220	29	162	84,457	1,991	166	126,295	2,860	19½
1882	117	48,208	999	1	455	9	90	51,421	1,155	208	100,082	2,163	19
1883	95	38,173	815	....	......	......	93	49,290	1,135	188	87,963	1,950	19
1884	81	34,412	714	2	606	16	92	50,178	1,133	175	85,193	1,863	19
1885	78	27,763	691	2	652	16	80	42,587	975	160	71,002	1,673	18½
1886	108	44,389	852	....	......	......	42	20,772	483	150	65,161	1,335	19
1887	127	57,035	1,059	5	2,349	45	26	13,023	298	158	72,407	1,402	....
1888	185	76,645	1,558	1	402	9	22	13,423	273	208	91,470	1,840	18½
1889	145	69,763	1,341	7	4,349	62	61	19,837	453	213	93,949	1,856	18½
1890	169	58,058	1,158	5	1,964	41	28	10,860	308	202	70,222	1,507	18½
1891	137	56,818	1,124	6	2,377	46	24	17,853	308	167	77,048	1,478	....
1892	168	69,627	1,369	1	353	7	25	17,446	334	194	87,426	1,710	18½
1893	134	58,310	1,076	4	1,918	33	33	31,417	486	171	91,640	1,595	18½
1894	81	39,158	653	3	1,215	23	58	52,751	852	142	95,124	1,528	17
1895	131	65,317	1,121	3	1,228	23	46	44,213	702	180	110,668	1,846	17
1896	92	42,024	717	1	342	8	55	53,499	876	148	95,523	1,591	....
1897	86	45,740	821	7	2,782	54	97	94,678	1,473	190	143,200	2,348	....
1898	44	18,347	333	5	2,070	38	108	108,599	1,417	161	129,016	1,788	....


DARIEN
SHOAL No 6
BROWN JOHN SHOAL

Arrivals and clearances of vessels at Darien, Ga., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	*Feet.*
1875	22	12,214	328	11	4,055	97	104	55,759	1,372	137	72,028	1,797	22
1876	39	9,300	270	4	1,553	32	180	87,489	2,263	223	98,342	2,565	21
1877	44	13,209	314	4	842	21	169	92,795	2,154	217	106,846	2,489	20
1878	28	7,842	181	6	3,000	62	149	83,385	1,947	183	94,236	2,190	20
1879	40	14,052	301	7	2,765	57	125	65,433	1,538	172	82,250	1,896	19½
1880	55	17,076	393	7	3,589	72	168	84,172	2,016	230	104,837	2,481	19½
1881	80	28,492	617	8	3,120	70	184	95,353	2,164	272	126,965	2,851	19½
1882	93	34,098	709	6	1,962	46	115	63,525	1,434	214	99,585	2,189	19
1883	66	25,019	510	9	3,533	72	108	56,411	1,340	183	84,963	1,931	19
1884	59	20,637	457	11	3,977	85	119	66,337	1,478	189	90,951	2,020	19
1885	46	16,649	339	8	3,354	62	98	52,742	1,198	152	72,745	1,599	18½
1886	93	38,295	719	10	3,682	80	50	24,376	564	153	66,358	1,363	19
1887	126	55,592	1,016	12	1,144	17	16	8,612	189	144	65,700	1,222	....
1888	155	64,749	1,318	2	538	15	36	23,742	453	193	89,029	1,786	19
1889	155	63,347	2,091	6	4,333	66	46	26,488	528	207	94,168	2,685	....
1890	171	58,810	1,174	3	962	23	31	15,569	336	205	75,351	1,533	....
1891	127	53,890	1,031	3	896	20	26	18,006	256	156	72,792	879	....
1892	161	69,488	1,310	2	917	16	33	21,502	418	196	91,807	1,744	....
1893	137	56,297	1,115	1	300	6	46	40,150	630	184	96,747	1,751	....
1894	75	33,478	583	1	479	8	61	57,772	894	137	91,689	1,485	17
1895	124	55,829	970	1	817	16	53	51,599	818	178	108,245	1,804	17
1896	93	41,900	705	....	....	....	62	59,594	926	155	101,494	1,631	....
1897	80	23,750	593	....	....	....	95	94,742	1,500	175	128,492	2,093	....
1898	43	16,753	318	1	413	8	108	109,743	1,651	152	126,909	1,977	....

Timber shipments from port of Darien, Ga., from January 1, 1875, to December 31, 1878.

Year.	Foreign.		Coastwise.		Total.	
	Superficial feet.	Value.	Superficial feet.	Value.	Superficial feet.	Value.
1875	41,447,024	$557,524	10,992,600	$181,377	52,439,624	$738,901
1876	60,762,000	735,099	8,370,000	138,105	69,132,000	873,204
1877	64,378,000	776,856	11,888,100	196,153	76,266,100	973,010
1878	59,697,124	716,365	7,057,800	116,454	66,754,924	832,819
1879	47,217,818	566,613	12,646,800	208,672	59,804,618	775,285
1880	74,612,520	895,350	15,368,500	253,579	89,981,020	1,148,929
1881	65,420,876	785,050	25,642,800	423,106	91,063,676	1,208,156
1882	36,639,379	439,672	30,688,200	506,355	67,327,579	946,027
1883	42,385,000	508,620	22,517,100	371,532	64,902,100	880,152
1884	50,656,000	607,872	18,573,300	306,459	69,229,300	914,331
1885	40,101,000	501,262	14,984,100	247,938	55,085,100	749,200
1886	19,960,000	219,500	24,465,000	661,440	54,425,000	870,940
1887	12,023,611	138,476	50,349,600	912,220	62,373,211	1,056,960
1888	17,975,371	215,705	65,998,200	1,121,960	83,975,571	1,337,665
1889	20,772,265	237,652	50,667,660	760,144	71,449,865	997,816
1890	10,962,017	140,746	68,223,683	949,762	79,185,700	1,090,508
1891	13,785,333	274,674	45,519,707	910,718	59,305,040	1,185,392
1892	12,893,730	179,616	49,708,879	1,093,595	62,602,609	1,273,211
1893	33,300,000	399,600	41,375,100	827,502	74,675,100	1,227,102
1894	47,910,319	583,671	30,094,750	571,789	78,004,519	1,155,460
1895	39,602,963	426,451	44,660,000	803,880	84,262,963	1,228,331
1896	43,059,139	461,148	34,150,251	341,502	77,209,390	802,650
1897	74,170,144	763,557	27,000,000	324,000	101,170,144	1,087,557
1898	90,267,216	1,783,326	6.980,688	575,057	97,347,904	2,358,383

Commerce.

Year.	Value of exports.	Value of imports.	Total collections.
1880	$1,621,904	$5,600	$11,806.72
1881	1,137.490	3,356	18,980.02
1882	1,073,008	1,025	11,254.19
1883	969,834	2,334	11,067.37
1884	1,038,185	11	9,688.20
1885	860,500	....	2,359.01
1886	1,037,330	....	1,716.46
1887	1,221,000	....	1,060.97
1888	2,100,000	2,600	964.13
1889	997,816	....	1,784.03
1890	140,746	....	968.95
1891	1,530,000	....	1,198.28
1892	1,452,827	....	1,500.85
1893	1,406,718	....	1,930.21
1894	804,972	....	3,516.70
1895	1,228,000	....	2,631.24
1896	802,651	....	3,353.98
1897	1,087,557	....	6,060.88
1898	1,783,326	....	6,834.15

JOHN C. LAWTON,
Collector of Customs.

O 6.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

The Altamaha River is formed by the junction of the Oconee and Ocmulgee rivers, and flows in a southeasterly direction to the sea.

A detailed description of this river is given in Appendix O, Annual Report of the Chief of Engineers for 1890, pages 1327–1386.

ORIGINAL CONDITION.

The chief obstruction to the navigation of the Altamaha River consists in rock ledges, sand bars, overhanging trees, snags, and sunken logs. The rock ledges were confined to the upper portion of the stream, while the other obstructions were found throughout its entire course. The low-water depths at some points did not exceed 1 foot.

PLAN OF IMPROVEMENT.

The original plan for improving the Altamaha River is given in Appendix J of the Annual Report of the Chief of Engineers for 1881.

The revised plan of improvement, outlined in the report of the Chief of Engineers for 1890, page 1372, provides for the establishment of a navigable steamboat channel, 3 feet deep at ordinary summer low water, between the junction of the Oconee and Ocmulgee rivers and the town of Darien.

This is to be accomplished by (1) removing rock shoals and sand bars; (2) building deflecting dikes and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream; (4) revetting caving banks.

The cost of the improvement, as given in the project of 1890, is estimated in round numbers at $129,000, provided funds are regularly and adequately supplied.

From $3,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a history of work done under the original project see page 1246 of the Annual Report of the Chief of Engineers for 1889. For a summary of work done under the revised project see page 1514 of the same report for 1897.

The total expenditures under the present project up to June 30, 1898, amounted to $44,960.50; under previous project there had been expended $69,776.59; making a total of $114,737.09.

CONDITION OF WORK JUNE 30, 1898.

The training wall at Beards Bluff had deteriorated to some extent. The other works were in about the same condition as at the close of the previous fiscal year.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Work of snagging on this river was begun November 21, 1898, at Silver Bluff and continued until December 1, 1898, at lower Sisters Bluff, removing between those two points 143 snags, 4 stumps, and 27 overhanging trees.

CONDITION OF WORK JUNE 30, 1899.

The works heretofore put in have apparently not deteriorated during the past year. No examination has been made of the work at Coupers Bar. The prolonged high water of last year has brought in many snags which will require removal.

COMMERCE AND NAVIGATION.

The principal items of commerce of the river are timber and naval stores and the merchandise necessary to supply the camps of the producers of those articles. During the year 1898 it is estimated that 20,000,000 feet B. M. of timber went down the river, valued at $170,000, besides about 11,000 tons of general merchandise, valued at about $1,000,000.

Two steamers, running in conjunction, make one round trip every two weeks from Hawkinsville, on the Ocmulgee River, to Brunswick. Two steamers ply from Doctortown over most of the Altamaha, and their commerce is tributary to the Savannah, Florida and Western Railway at Doctortown.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1898, $23,080. Sapelo Light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river according to the project of 1890.

The sum of $10,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every freshet stage. They should, however, diminish in number from year to year.

A large appropriation was made March 3, 1899, for the improvement of the Ocmulgee River. This will be of local benefit only unless the Altamaha is improved to an equal degree.

Money statement.

July 1, 1898, balance unexpended	$5,262.91
Amount appropriated by river and harbor act approved March 3, 1899	6,000.00
	11,262.91
June 30, 1899, amount expended during fiscal year	3,757.15
July 1, 1899, balance unexpended	7,505.76
Amount (estimated) required for completion of existing project	101,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Altamaha River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$5,000.00
August 2, 1882	15,000.00
July 5, 1884	20,000.00
August 5, 1886	20,000.00
August 11, 1888	10,000.00
	70,000.00
Unexpended balance of last appropriation carried to new project	223.41
Total	69,776.59

Since the existing project for improving Altamaha River was adopted in 1890 the following appropriations have been made for this work:

By act of Congress of—		
August 11, 1888 (unexpended balance)	$223.41	
September 19, 1890	15,000.00	
July 13, 1892	15,000.00	
August 18, 1894	10,000.00	
June 3, 1896	10,000,00	
March 3, 1899	6,000.00	
Total		56,223.41
Grand total		126,000.00

O 7.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

The Oconee River rises in the northeastern part of Georgia, flows in a southeasterly direction, and unites with the Ocmulgee to form the Altamaha. A detailed description of this river is given in House Ex. Doc. No. 211, Fifty-first Congress, first session.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with low-water depths of not more than 2 feet. The chief obstructions to navigation consist of sand bars, rock shoals, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving the Oconee River is given in the Annual Report of the Chief of Engineers for 1875. That plan was modified in 1878, 1880, and 1888.

The present plan of improvement, outlined in the report of February 5, 1890, provides for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water from Milledgeville to the river's mouth.

This is to be accomplished by (1) removing rafts, rock shoals, and sand bars; (2) enlarging portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement is estimated at $171,000, provided funds are regularly and adequately supplied.

From $1,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a history of the work done under the original project of improvement see page 1253 of the Annual Report of the Chief of Engineers for 1889. For a summary of the work done under the present project see pages 1516 and 1517 of the same Report for 1897, and page 1309 of the same Report for 1898.

The total expenditures under the present project, up to June 30, 1898, amounted to $67,524.83, and under previous projects, $44,822.18; making a total of $112,347.01.

CONDITION OF WORK JUNE 30, 1898.

From the Forks up to nearly the Central Railroad Bridge the river was in good condition. Above that point it was very much obstructed and required clearing.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

Snagging was begun July 24, 1898, and continued until November 20, 1898. There were removed 932 snags and stumps, 221 overhanging trees, and 24 logs were cut on the bank; 590 pounds of explosives were used. A training dyke, about 450 feet long, was built at Lattimers Beach for the improvement of a bad shoal at that place. It was built by the crew of the snag boat *Satilla*. The dam at Fish Trap Cut was blown out.

CONDITION OF WORK JUNE 30, 1899.

The dam at Lattimers Beach was in good condition. The river was thoroughly cleaned of snags last fall, but the prolonged high water since then has brought in more which require removal.

COMMERCE AND NAVIGATION.

The Oconee River is navigable from the mouth to Milledgeville. During the year 1898 the boats plying the river carried about 10,000 tons of freight, valued at about $1,000,000. In addition to this there were about 65,000,000 feet B. M. of pine and cypress timber, valued at about $552,500, rafted down the river. Excepting the timber traffic the commerce on the river is carried in detached segments tributary to the railroads crossing the river.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1898, $23,080. Sapello Light is the nearest light-house, and forts Oglethorpe, Pulaski, and Screven are the nearest forts.

It is proposed to expend the funds available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river, according to the project of 1890.

Money statement.

July 1, 1898, balance unexpended	$2,652.99
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	12,652.99
June 30, 1899, amount expended during fiscal year	4,027.48
July 1, 1899, balance unexpended	8,625.51
July 1, 1899, outstanding liabilities	276.70
July 1, 1899, balance available	8,348.81
Amount (estimated) required for completion of existing project	112,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the works of improvement were begun the following appropriations have been made:

By act of Congress of—		By act of Congress of—	
June 18, 1878	$10,000.00	July 5, 1884	$3,000.00
March 3, 1879	1,500.00	August 5, 1886	9,000.00
June 14, 1880	1,500.00	August 11, 1888	12,500.00
March 3, 1881	2,500.00		
August 2, 1882	5,000.00		45,000.00
Unexpended balance from last appropriation carried to new project			201.18
Total			44,798.82

Since the existing project for improving the Oconee River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance	$201.18
September 19, 1890	25,000.00
July 13, 1892	25,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
March 3, 1899	10,000.00
Total	80,201.18
Grand total	125,000.00

O 8.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

The Ocmulgee River is formed by the junction of the South and Yellow rivers about 20 miles below Covington, and flows thence in a southeasterly direction about 250 miles, where it unites with the Oconee to form the Altamaha. A detailed description of this river is found in House Ex. Doc. No. 215, Fifty-first Congress, first session.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with depths of not more than 2 feet. The chief obstructions to navigation consist of rock shoals, sand bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving Ocmulgee River is given in the Annual Report of the Chief of Engineers for 1876. That project was revised in 1882 and again in 1886.

The present plan of improvement, outlined in report of the Chief of Engineers for 1890, page 1458, provides for the establishment of a navigable channel, 3 feet deep at ordinary summer low water, from Macon to the river's mouth.

This is to be obtained by (1) removing rock shoals and sand bars; (2) closing incipient cut-offs and revetting caving banks; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement, as given in the project of 1890, is estimated at $210,000, provided funds are regularly and adequately supplied.

From $1,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a history of the work done under the original project see page 1258 of the Annual Report of the Chief of Engineers for 1889. For a summary of the work done under the present project see pages 1519 and 1520 of the same report for 1897, and pages 1311 and 1312 of the same report for 1898. The total expenditures under the present project up to June 30, 1898, amounted to $75,048.27, and under previous projects $79,390.73, making a total of $154,439.

CONDITION OF WORK JUNE 30, 1898.

The work heretofore done on the river in removing rock shoals was in good condition; the contraction works for sand bars were in fair condition, but the river was somewhat obstructed by snags.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1899.

The rock bars need deepening, particulary Stadems Shoals, below Abbeville. The prolonged high water of the past year has filled the river with snags and the river needs correction at several threatened cut-offs.

COMMERCE AND NAVIGATION.

A detailed discussion of this subject will be found on pages 1478 to 1484 of the Report of the Chief of Engineers for 1890, and page 1520 of the same report of 1897. At present there is no navigation at all between Macon and Hawkinsville, except that one small steamer occasionally goes to Macon. From Hawkinsville two boats in conjunction make a round trip once in two weeks to Brunswick. One boat plies from Lumber City about 70 miles up the river, running tributary to the Southern Railway.

During the year 1898 45,000,000 feet B. M. of timber were rafted down the river, valued at about $382,500, and 20,000 tons of naval stores and merchandise, valued at $1,000,000, were handled. The last of these amounts is estimated, parties interested in navigation not replying to queries concerning commerce.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1898, $23,080. Sapelo Light is the nearest light-house, and Forts Oglethorpe, Pulaski, and Screven are the nearest forts.

The river and harbor act of March 3, 1899, made an appropriation of $20,000 for the improvement of this stream and authorized continuing contracts for $136,000 more. As one of the principal items in the improvement of this stream is the removal of snags, which work can not be advantageously done by contract, and the removal of rock shoals, which must be done when the opportunity of extreme low water offers, it will be to the advantage of the United States to do the entire work by hired labor rather than by continuing contracts, provided appropriations can be as regularly made for hired labor as for continuing contracts. The $20,000 made available by the act of March 3, 1899, will be expended during the coming fiscal year. For the following year the sum of $40,000 can be advantageously expended—more advantageously if it can be provided without requiring a continuing contract. If this work be done by continuing contract competition will necessarily be limited to persons residing near the river, as no contractor at a distance can afford to keep in readiness to take advantage of extreme low water each year as it happens to come without receiving very high prices for his work. Another disadvantage is that to pull snags requires a snag boat. A contractor would have no use for such boats after the contract was finished, whereas the United States will always need them. It would therefore be unduly expensive to do this work by continuing contract.

It is to be noted in this connection that the advantage of doing work by hired labor is somewhat offset by the necessity of the Government paying as much for eight hours' labor as other people in the vicinity pay for ten—a requirement of the so-called eight-hour law. This law does not appear to be enforced as regards contractors.

Money statement.

July 1, 1898, balance unexpended	$61.00
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	20,061.00
June 30, 1899, amount expended during fiscal year	1,794.27
July 1, 1899, balance unexpended	18,266.73
July 1, 1899, outstanding liabilities	276.70
July 1, 1899, balance available	17,990.03
Amount (estimated) required for completion of existing project	136,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Ocmulgee River, adopted in 1876, the following appropriations were made:

By act of Congress of—		
August 14, 1876	$15,000.00	
June 18, 1878	15,000.00	
March 3, 1879	7,000.00	
June 14, 1880	7,000.00	
March 3, 1881	5,000.00	
August 2, 1882	5,000.00	
July 5, 1884	3,000.00	
August 5, 1886	7,500.00	
August 11, 1888	15,000.00	
		$79,500.00
Unexpended balance carried forward from last appropriation to new project		224.95
Total		79,275.05

Since the existing project for improving Ocmulgee River was adopted the following appropriations have been made for the work:

By act of Congress of—		
August 11, 1888 (unexpended balance)	$224.95	
September 19, 1890	30,000.00	
July 13, 1892	25,000.00	
August 18, 1894	10,000.00	
June 3, 1896	10,000.00	
March 3, 1899	20,000.00	
Total		95,224.95
Total, all appropriations		174,500.00

O 9.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

About 2 miles above the city of Brunswick, Turtle River is divided by Buzzard Island into two branches, the smaller one flowing to the eastward of the island and upon which the city of Brunswick is situated, being known as East River, the other retaining the name of Turtle River. The lower part of East River forms what is known as the Harbor of Brunswick. Map showing Brunswick Harbor accompanies this report.

ORIGINAL CONDITION.

Turtle and Brunswick rivers have low-water depths of from 4 to 6 fathoms. Over the shoal in East River in front of the city there was, when the existing project of improvement was adopted, a low-water depth of only 1½ fathoms. The mean rise and fall of tide is about 6.6 feet.

PLAN OF IMPROVEMENT.

Operations for the improvement of this harbor have been carried on in accordance with a project of improvement printed as Appendix M 12, Annual Report of the Chief of Engineers for 1886. This project is an enlargement and a modification of a previous one printed as Appendix J 7, Annual Report of the Chief of Engineers for 1880.

The following comprise the main features of the plan of improvement:

(1) A training wall projecting from the most easterly point of Buzzard Island and located approximately parallel to and 1,000 feet or less distant from the opposite shore of East River.

(2) A low dam across Turtle River extending obliquely upstream from the upper end of Buzzard Island to the opposite shore of Blythe Island.

(3) Short spur jetties in the lower part of East River.

(4) Dredging in the vicinity of Turtle River Dam and on the shoal in the lower part of East River.

The training walls and spurs were to be constructed of palmetto cribs loaded with stone or of successive courses of log and brush mattresses loaded wite riprap stone. The works were intended to establish and maintain a 15-foot low-water channel across the shoal in East River. The cost of the original project was estimated at $73,187.50, and as modified at $190,000.

The present project, adopted in 1894, is for maintenance at the estimated rate of $15,000 a year.

In 1836 an appropriation of $10,000 was made for the removal of the shoal in East River. Since the adoption of the modified project nine appropriations have been made by Congress for the work, aggregating $190,000. Three additional appropriations, of $10,000, $15,000, and $10,000, were made for maintenance, one in 1894, one in 1896, and one in 1899.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

For a summary of past work, see page 1274 of the Report of the Chief of Engineers for 1896, page 1523 of the same report for 1897, and page 1314 of the same report for 1898. The total expenditures under the present project for maintenance up to June 30, 1898, amounted to $24,375.56; under previous projects, $200,000, making a total of $224,375.56, including $10,000 spent in 1836 for dredging.

CONDITION OF WORK JUNE 30, 1898.

No examination of Brunswick Harbor had recently been made, but, so far as known, the training wall was in fair condition and the channel had not deteriorated. It was not quite uniform in depth.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

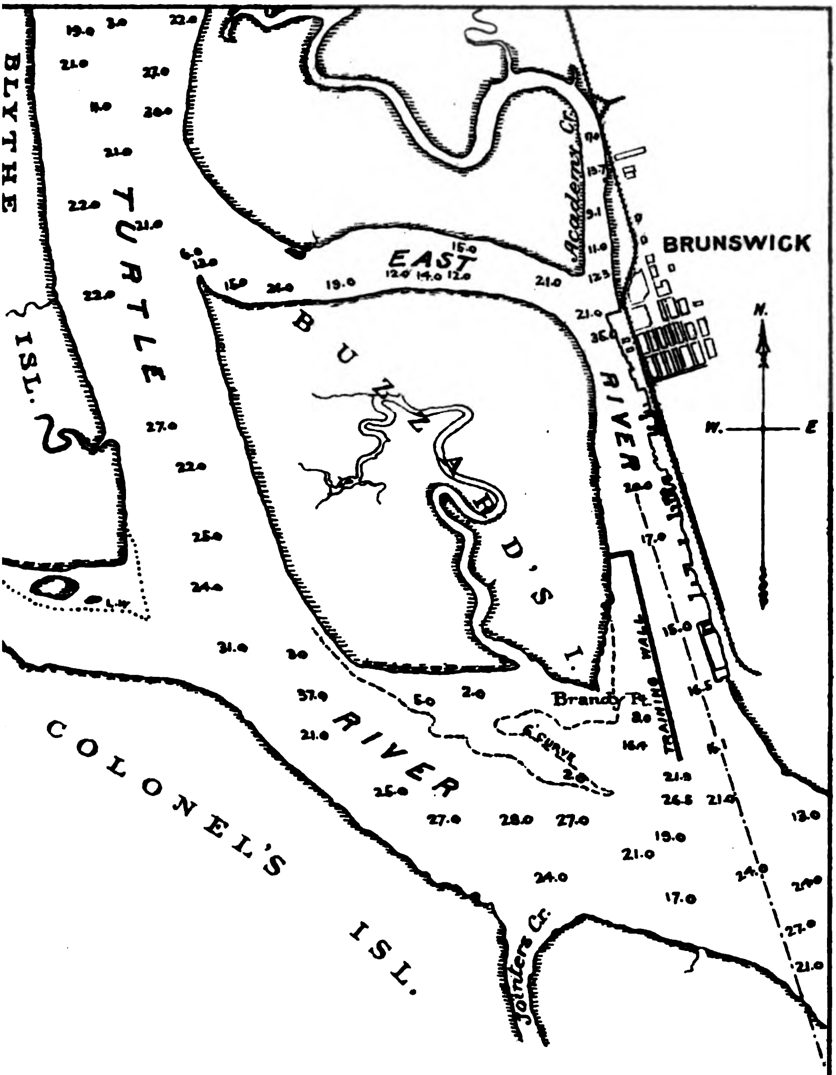
No work was done in this harbor during the fiscal year.

CONDITION OF WORK JUNE 30, 1899.

The training wall is in fair condition. The channel needs redredging.

COMMERCE AND NAVIGATION.

Information in regard to the commerce of Brunswick before the improvement will be found on page 1523 of the Report of the Chief of Engineers for 1897. Since 1880 the annual tonnage of the port and its value have grown very much, the shipments of cotton, for instance, having increased from 4,000 bales in 1885 to 200,541 bales in 1897.



MAP OF
BRUNSWICK HARBOR.
1899

SCALE OF MILES

1M. 3/4 1/2 1/4 0 1M.

Official
Cassius E. Gillette
Capt, of Engrs.

Guggenheimer, Weil & Co. Photo.-Litho. Baltimore.

Besides a line of steamers to New York and several lines to points in Georgia and Florida, a large fleet of foreign and coastwise steam and sailing vessels is engaged in the Brunswick trade, which consists principally of shipments of cotton, naval stores, lumber, ties, and phosphates.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1898, $23,080. St. Simons Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

The river and harbor act of March 3, 1899, provides for a preliminary examination or survey at "Brunswick, Georgia: Inner harbor, with a view of determining what improvement thereof is desirable in the interest of commerce and the cost thereof."

To maintain the existing channel depths during the coming fiscal year the sum of $10,000, appropriated March 3, 1899, will be requisite. To maintain it during the fiscal year ending June 30, 1901, it is estimated that $10,000 additional will be needed.

Money statement.

July 1, 1898, balance unexpended	$624.44
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	10,624.44
June 30, 1899, amount expended during fiscal year	478.41
July 1, 1899, balance unexpended	10,146.03
July 1, 1899, outstanding liabilities	133.34
July 1, 1899, balance available	10,012.69
Amount (estimated) required for completion of existing project	(1)
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the work of improvement was begun the following appropriations have been made:

By act of Congress of—		By act of Congress of—	
July 4, 1836	$10,000	August 5, 1886	$22,500
March 3, 1879	20,000	August 11, 1888	35,000
June 14, 1880	10,000	September 19, 1890	35,000
March 3, 1881	5,000	July 13, 1892	27,500
August 2, 1882	25,000		
July 5, 1884	10,000	Total	200,000

For maintenance:	
August 18, 1894	10,000
June 3, 1896	15,000
March 3, 1899	10,000
Aggregate	235,000

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[1] Indeterminate.

COMMERCIAL STATISTICS FOR 1898.

Exports.

Articles.	Foreign.	Domestic (coastwise).
Cotton ....bales..	311,916	14,848
Cotton seed ....tons..	4,537	....
Yarn ....bales..	....	1,442
Phosphate ....tons..	66,351	....
Rosin ....barrels..	209,648	35,012
Turpentine ....do....	48,969	21,903
Lumber and timber ....feet, B. M..	18,876,000	111,228,000
Cross-ties ....No..	44,129	1,051,518
Shingles ....do....	1,808,000	3,431,810
Laths ....do....	30,500	75,000
Pig iron ....tons..	21,194	....
Oysters ....cases..	....	....
Merchandise ....tons..	413	2,096
Staves ....No..	9,453	....
Meal and oil cakes ....tons..	2,964	....
Cotton-seed oil ....barrels..	....	7,718

Exports and imports.

	Tons.	Value.
Exports, domestic (coastwise) and foreign	573,370	$15,259,533
Imports	35,630	6,995,941
Total	609,000	22,255,474

Arrivals and clearances of vessels and commerce at Brunswick, Ga., from January 1, 1878, to December 31, 1898.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	116	32,584	850	36	10,218	270	41	19,008	493	193	61,810	1,613
1879	148	44,397	1,000	33	8,235	232	40	17,589	468	221	70,221	1,790
1880	271	77,656	1,891	36	11,219	317	39	14,996	432	346	103,871	2,641
1881	279	100,451	2,239	13	4,174	98	63	30,279	751	355	134,904	3,088
1882	335	123,149	2,659	7	2,095	57	63	26,958	694	405	152,202	3,416
1883	299	110,302	2,368	11	4,814	107	87	40,765	979	397	155,881	3,454
1884	239	88,063	1,893	10	4,434	88	126	62,818	1,435	375	155,315	3,416
1885	242	93,280	1,928	10	3,216	76	94	43,284	1,037	346	139,780	3,052
1886	229	88,244	1,751	7	3,262	48	98	47,798	1,164	334	139,304	2,835
1887	194	86,731	1,625	8	2,251	116	102	54,537	1,232	304	144,519	2,973
1888	821	290,590	3,619	9	2,991	76	147	80,330	1,729	977	373,911	10,424
1889	220	92,831	1,764	29	10,035	176	191	113,757	2,403	431	216,623	4,343
1890	316	196,701	3,844	23	7,513	186	126	71,158	1,559	465	275,372	5,589
1891	374	235,565	5,462	29	8,025	164	107	70,228	1,523	501	313,818	6,149
1892	439	279,998	4,450	42	20,548	354	134	85,332	1,812	615	385,878	6,616
1893	431	255,367	4,392	48	23,384	371	123	93,634	1,710	602	372,385	6,473
1894	382	261,315	4,926	50	25,382	393	173	147,672	2,675	605	434,369	7,994
1895	481	319,399	5,750	25	14,867	242	147	112,957	2,089	653	447,223	8,081
1896	587	344,045	6,503	40	19,999	359	134	63,348	1,852	761	427,392	8,714
1897	716	417,847	7,783	84	42,543	717	260	232,762	4,158	1,060	693,143	12,658
1898	767	406,088	6,701	49	28,278	456	246	262,431	4,299	1,062	696,797	11,456

Arrivals and clearances of vessels and commerce at Brunswick, Ga., etc.—**Continued.**

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	124	32,767	874	28	9,231	236	49	21,218	550	201	63,216	1,660
1879	157	42,345	1,116	21	7,172	172	47	21,730	555	225	71,247	1,843
1880	270	78,913	2,010	14	5,010	115	48	19,970	550	332	103,900	2,675
1881	252	82,155	1,732	17	7,218	156	87	42,659	1,014	356	132,982	1,902
1882	278	96,170	2,086	19	7,761	170	101	48,699	1,189	398	152,630	3,395
1883	257	91,036	1,962	28	11,268	240	124	55,717	1,369	411	158,021	3,571
1884	176	62,927	1,322	38	16,209	335	148	70,612	1,633	362	149,478	3,290
1885	196	71,345	1,481	21	8,696	190	135	62,437	1,456	352	142,478	3,127
1886	184	67,020	1,413	17	7,528	159	117	56,280	1,305	318	130,828	2,877
1887	130	51,305	958	5	5,858	143	121	72,894	1,526	276	130,057	2,627
1888	785	266,152	8,240	13	4,715	116	173	102,300	2,236	971	373,227	10,592
1889	169	65,809	1,273	11	4,266	103	221	130,919	2,830	401	200,994	4,206
1890	247	122,820	2,024	18	8,745	165	172	107,197	2,261	437	238,762	4,450
1891	313	186,171	3,432	26	16,045	234	141	94,827	1,980	480	297,043	5,646
1892	390	247,329	4,228	19	6,882	174	163	109,728	2,334	572	363,939	6,736
1893	420	236,856	4,165	13	6,857	121	159	119,282	2,266	590	362,995	6,552
1894	363	235,307	4,481	14	6,081	125	223	193,483	3,260	600	434,871	7,886
1895	458	290,702	5,260	9	4,155	103	182	148,892	2,811	649	443,749	8,174
1896	591	323,357	5,759	18	8,638	173	150	112,446	2,248	759	444,441	8,180
1897	764	432.089	6,940	15	6,155	117	274	246,302	4,326	1,053	684,546	11.383
1898	769	406,016	6,255	12	6,028	99	255	265,381	4,371	1,036	677,425	10,725

COMMERCE.

Year.	Value of exports.	Value of imports.	Total collection.	Year.	Value of exports.	Value of imports.	Total collection.
1878	$1,372,842	$400	$4,500.97	1889	$7,894,281	$6,557	$8,933.66
1879	1,394,401	3,197	5,644.33	1890	7,355,841	7,326	5,748.00
1880	1,702,570	8,098	17,723.27	1891 *a*	9,742,553	3,014,207	5,982.07
1881	2,230,000	4,377	29,305.30	1892	5,372,775	22,988	6,408.15
1882	1,700,000	2,734	20,058.90	1893 *a*	7,297,973	1,680,512	5,768.00
1883	3,437,000	3,093	24,911.61	1894 *a*	9,940,453	3,549,878	9,141.41
1884	3,500,000	958	19,780.32	1895 *a*	7,520,404	3,328,407	7,422.10
1885	3,063,960	4,008	3,939.27	1896	5,727,074	15,072	8,047.11
1886	2,828,656	2,397	5,834.43	1897 *a*	12,582,114	5,803,110	18,586.57
1887 *a*	4,121,660	2,815,769	37,520.00	1898 *a*	15,259,533	6,995,941	23,080.00
1888 *a*	7,552,025	3,140,231	7,438.04				

a Coastwise and foreign.

Statement of receipts of naval stores.

Year.	Receipts for year.		Year.	Receipts for year.	
	Rosin.	Spirits.		Rosin.	Spirits.
	Barrels.	*Barrels.*		*Barrels.*	*Barrels.*
1880	36,495	8,661	1890	212,374	42,813
1881	67,562	18,490	1891	161,402	42,697
1882	104,357	23,459	1892	220,250	52,496
1883	80,078	16,105	1893	172,412	43,100
1884	105,622	23,449	1894	187,912	46,954
1885	92,958	30,900	1895	268,349	53,329
1886	139,366	34,625	1896	259,103	66,286
1887	125.546	32,388	1897	328,155	77,441
1888	140.820	37,643	1898	245,311	71,459
1889	186.000	45,000			

HENRY T. DUNN,
Collector of Customs.

O 10.

IMPROVEMENT OF THE INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA.

The location of this route is shown by a dotted line on Coast Survey Charts Nos. 156 and 157, and a detailed description of it is given in Appendix N 12, Annual Report of the Chief of Engineers for 1892, pages 1311–1326. (See also subsequent reports.)

The distance from Savannah to Fernandina by the inside route just described is about 160 miles.

Touching at Darien en route increases the distance by about 20 miles, and at Brunswick by about 12 miles.

Map showing the inside route accompanies this report.

ORIGINAL CONDITION.

The points at which navigation was originally obstructed were Romerly Marshes, Mud River, Jekyl Creek, and the "Dividings" in Cumberland River.

Specific appropriations have been made by Congress for the improvement of the channels forming a portion of this route as follows: Parsons Cut, or Romerly Marshes, $47,108.77; Jekyl Creek, $24,000, and under the title of "Inside Route," $49,000. The last appropriation was expended at Jekyl Creek and Mud River. Previous to the improvement of any of these points navigation was obstructed by shoals, usually of soft mud.

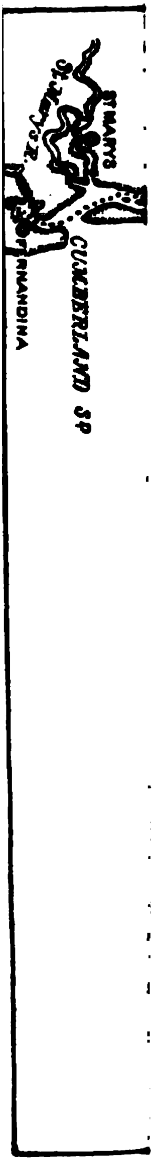
The coast of Georgia consists of a series of low sand islands separated by bays usually called sounds. Back of the islands and surrounding the sounds is a very large territory of salt marshes, through which meander deep, clear salt-water sloughs, maintained by tidal flow. They are connected together and the most available ones have been selected as a route for vessels of moderate size, permitting a navigation in still water instead of the open sea. Back of each sand island and midway between each tidal sound is usually a point where the tides meet, and this is naturally a region of shoal water requiring improvement to permit of thorough navigation. The points named above constitute such shoals.

PLAN OF IMPROVEMENT.

The original project of improvement adopted in 1892 provides for the establishment of a channel 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek by means of dredging and the construction of closure dams and training walls of brush mattresses loaded with riprap stone. The estimated cost of the improvement is $105,000, provided that the entire sum is made at once available.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1898.

A summary of operations at Jekyl Creek will be found on page 1536 of the Annual Report of the Chief of Engineers for 1897, and page 1318 of the same report for 1898; for Mud River in the same report for 1898, page 1318; for Romerly Marsh, or Parsons Cut, in the same report for 1890, page 1368.


ST MARYS
St. Mary's R.
CUMBERLAND SD
RNANDINA

CONDITION OF WORK JUNE 30, 1898.

Parsons Cut in past years had shoaled and widened. The cut at Mud River was in good condition as far as completed, but the appropriation was exhausted before connection was made with the deep water at one end. The material where the cut was made was rather hard and the cut is narrow. It will have to be completed and widened before it can be used. The training wall at the mouth of Jekyl Creek was in good condition so far as known. The channel in the creek had shoaled. No work had been done at Little Mud River or the "Dividings."

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done during the fiscal year.

CONDITION OF WORK JUNE 30, 1899.

There has been no particular change during the past year. Parsons Cut has about 3½ feet of water. The other route through Romerly Marshes has about 4 feet, and Jekyl Creek about 5 feet at mean low water.

COMMERCE AND NAVIGATION.

For a detailed discussion of the commerce over the inside route see pages 1323 and 1324 of the Annual Report of the Chief of Engineers for 1892; also page 1536 of the same officer's Annual Report for 1897.

There is little navigation that goes the full length of the route, but there are large navigation interests concerned with different sections of the route. Beginning at the northern end; there is an extensive summer navigation between Savannah and Thunderbolt and Warsaw Island, and at all seasons numerous small boats ply between oyster beds and canning factories. Between Savannah and Darien sailboats ply irregularly, carrying rice and other produce. Between Darien and Sapelo Sound there is an enormous timber trade, which is much hampered by the incomplete state of the dredging in Mud River. Between Darien and St. Simons Mills, and other mills near Brunswick, is also a very extensive timber trade. There is a small daily steamer each way between Darien and Brunswick; also one between Brunswick and St. Simons Mills. A large steamer makes a round trip daily between Brunswick and Fernandina, running in connection with the Mallory Line of steamers from Brunswick to New York. Several river boats use portions of the route in reaching Brunswick from the Altamaha, Satilla, and Little Satilla rivers, and in reaching Fernandina from the St. Marys River. All told, the commerce is much more extensive than the commercial statistics would indicate, as from the nature of the case a record of a large portion of the commerce is difficult to obtain. For the calendar year 1898 it is estimated at about 40,000 tons of merchandise, valued at about $1,500,000, besides 13,000,000 feet B. M. of timber, valued at $1,100,000. None of this commerce passed over the whole extent of the route.

MISCELLANEOUS.

The work is located in the collection districts of Savannah, Brunswick, St. Marys, Ga., and Fernandina, Fla. The amount of duties collected in 1898 was: Savannah, $36,907.33; Brunswick, $23,080; St Marys (not furnished), and Fernandina (not furnished), respectively. The nearest light-houses are those upon the Savannah River, near the beginning, and Smelia Light at the end of the route, with Sapelo, Wolf Island ranges, St. Simon, and Little Cumberland lights between. Forts Oglethorpe, Pulaski, and Screven, Ga., and Clinch, Fla., are the nearest forts.

Money statement.

July 1, 1898, balance unexpended	$1,350.57
June 30, 1899, amount expended during fiscal year	1,214.98
July 1, 1899, balance unexpended	135.59
Amount (estimated) required for completion of existing project	56,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Previous to the existing project there were appropriated as follows:

Parsons Cut or Romerly Marshes, Georgia:		
Act of Congress approved—		
August 2, 1882	$10,000.00	
July 5, 1884	10,000.00	
August 5, 1886	17,475.00	
August 11, 1888	4,633.77	
Total by United States	42,108.77	
From Georgia and Florida Steamboat Company	5,000.00	
		$47,108.77
Jekyl Creek, Georgia:		
Act of Congress approved—		
August 11, 1888	5,000.00	
September 19, 1890	7,500.00	
July 13, 1892	7,500.00	
August 18, 1894	4,000.00	
		24,000.00

Since the existing project for improving this route was adopted three appropriations, aggregating $49,000, have been made, as follows:

Inside route:		
Act of Congress approved—		
July 13, 1892	$15,000.00	
August 18, 1894	20,000.00	
June 3, 1896	14,000.00	
		49,000.00
Making a total of		120,108.77

O II.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK OF BARK-LIGHTER "CYPHER" AND A SUNKEN DUMP SCOW IN SAVANNAH HARBOR, GEORGIA.

On March 10, 1899, the Secretary of War allotted $1,200 for the purpose of removing the wreck of the bark-lighter *Cypher*, sunk at the mouth of Calibogue Sound, Savannah Harbor. It was proposed to remove this wreck with the United States snag boat, but it has not yet become available for the work, and in the meantime the wreck appears to be disappearing in the sand and may not require removal.

On November 3, 1898, the Secretary of War allotted $1,000 for the purpose of removing a dump scow sunk nearly opposite Barnard street, Savannah, Ga., in Savannah Harbor. A contract was made with Von Eberstein & Judkins, of Savannah, Ga., who removed the wreck for $600. It was lifted bodily and deposited behind the Fig Island jetty. The unexpended balance of $400 was returned to the Treasurer of the United States.

APPENDIX P.

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF FLORIDA.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, LIEUT. COL. W. H. H. BENYAURD AND CAPT. C. H. McKINSTRY, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Cumberland Sound, Florida.
2. St. Johns River, Florida.
3. St. Johns River, Orange Mills Flats, Florida.
4. Volusia Bar, Florida.
5. Ocklawaha River, Florida.
6. St. Augustine Harbor, Florida.
7. Indian River, Florida.
8. Key West Harbor, Florida, and entrance thereto.
9. Removing the water hyacinth from Florida waters.
10. Dredge for river and harbor improvements, Florida.

SURVEY.

11. For removal of water hyacinths from the navigable waters of Florida and Louisiana.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., July 22, 1899.

GENERAL: I have the honor to submit herewith annual reports upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1899.

* * * * * * *

Very respectfully, your obedient servant,

C. H. McKINSTRY,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

P 1.

IMPROVEMENT OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

For information relative to the original plan of improvement of this locality see page 792, Annual Report of the Chief of Engineers for 1879. A revised plan, submitted in 1891, is printed on pages 1565 et seq., Annual Report of Chief of Engineers for 1891. A second revision of the original plan of improvement, submitted June 12, 1895, and the report of a board of engineer officers dated December 18, 1895, are printed on pages 1293 and 1289, respectively, Annual Report Chief of Engineers for 1896. This finally revised project was adopted by Congress by the river and harbor act of June 3, 1896.

The cost of the improvement was originally estimated at $2,071,023; as revised in 1891, at $2,079,500, and as revised in 1895, at $2,350,000, for completion.

In accordance with concurrent resolution No. 9, passed by the Senate May 26, 1897, and by the House of Representatives June 10, 1897, a special report upon the condition of the harbor of Cumberland Sound was submitted June 25, 1897, and is printed upon pages 1533 to 1535, Annual Report of the Chief of Engineers for 1897. This report recommended that dredging be commenced in accordance with the adopted project. The sum of $50,000 was appropriated for the purpose by the deficiency appropriation act approved July 19, 1897.

A continuing contract was entered into October 8, 1896, with the Atlantic Contracting Company, of New York, for the jetty work required by the project adopted by act of June 3, 1896.

Work under this contract, begun December 7, 1896, was suspended October 9, 1897. For a record of the work accomplished reference is invited to page 1324, Annual Report of Chief of Engineers for 1898. The estimated total amount of work to be done under this contract at time of letting was $2,141,250. When work was suspended, the contractors had earned $604,685.21 (subject to reduction) and had been paid $345,000, leaving a balance due of $259,685.21 (subject to reduction). The act of July 1, 1898, appropriated $450,000, and the act of March 3, 1899, appropriated $400,000. The project submitted for the expenditure of the amount of these appropriations, over and above the amount due the contractors, contemplates building up the north jetty to mean high water between stations 9000 and 19000, in the manner contemplated by the adopted project.

The work accomplished during the fiscal year ending June 30, 1898, with the appropriation of $50,000 for dredging, made by act of July 19, 1897, is described on page 1325, Report of the Chief of Engineers for that year. Dredging across the bar and up to the south jetty crossing was continued until June 4, 1898. A depth of 17 feet over that portion of the channel was obtained. The U. S. dredge *Cape Fear*, which had been engaged upon the work, was fitted with rock grapples and tried to deepen the cut through the south jetty, but with very poor success. Another plant was engaged for this work and the *Cape Fear* returned to the work of dredging beyond the jetty crossing out to sea, where she removed an additional amount of 19,316 cubic yards, making a total, since she began dredging March 24, 1898, of 77,444 cubic yards. She had removed from the jetty crossing 50¾ cubic yards of rock and 15 logs. A hired plant commenced work on the jetty crossing July 27 and discontinued October 5, 1898. This plant removed from the jetty 1,187.1 cubic yards of rock, etc., and 351 logs. Three cuts, each 35 feet wide and 17 feet deep at mean low water, were made across the jetty, and some work was accomplished on a fourth cut. The work resulted in making a channel 105 feet wide and 17 feet deep at mean low water across the jetty, or a channel 140 feet wide and 16 feet deep throughout.

A survey made in June, 1899, the map of which is submitted herewith, shows that the shoalest water in the channel is found on the outer bar, where there is a depth of 18 feet. This depth extends over a width of probably 100 feet, and the width of channel of 17 feet depth and over is probably 300 feet. From the outer bar to near the jetty crossing there is a wide channel more than 20 feet deep, except at one place, where there is a width of at least 200 feet between the 19-foot contours.

In the jetty crossing there appears to be a depth of 19 feet and more, over a width of 100 feet. A shoal has formed in the channel just beyond the jetty crossing going out, where there is slightly less than 18 feet at mean low water. This shoal can be avoided by vessels, but it requires an awkward turn to do so.

The apparent tendency for the formation of a channel across the bar between the jetties still exists, and there has been a slight improvement in that direction. While at the shoalest point there is still less than 6 feet at mean low water, the channel is widening and deepening and the distance across the shoalest portion is decreasing.

A comparison of the maps of the annual surveys of 1898 and 1899 shows that the large shoal lying between the jetties and overlapping the south jetty outside the sailing gap is closer to the sailing gap now than it was, and it is apprehended that this shoal will advance into the channel at the jetty crossing, and frequent dredging will be required to keep the channel clear.

From the best information at hand it is believed that there has been little, if any, change in the condition of the jetties during the year.

An estimate of $400,000 is submitted as amount that can be profitably expended during the fiscal year ending June 30, 1901.

The work is located in two collection districts, the north jetty being in the district of St. Marys, Ga., and the south jetty in that of Fernandina, Fla. Amelia Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

Money statement.

July 1, 1898, balance unexpended		$487,904.50
Amount appropriated by sundry civil act approved March 3, 1899		400,000.00
		887,904.50
July 30, 1899, amount expended during fiscal year		29,270.50
July 1, 1899, balance unexpended		858,634.00
July 1, 1899, outstanding liabilities	$260,091.86	
July 1, 1899, amount covered by uncompleted contracts[1]	1,536,564.79	
		1,796,656.65
Amount (estimated) required for completion of existing project		1,095,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901		400,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improving Cumberland Sound the following appropriations were made for the work:

June 14, 1880	$30,000	
March 3, 1881	100,000	
August 2, 1882	50,000	
July 5, 1884	75,000	
August 5, 1886	112,500	
August 11, 1888	112,500	
Total		$480,000

Under the revised project of improvement the following appropriations were made:

September 19, 1890	$112,500	
July 13, 1892	170,000	
August 18, 1894	170,000	
Total		452,500

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[1] This work is carried on under a continuing contract.

Under the existing project of improvement the following appropriations have been made:

June 3, 1896	$5,000
June 4, 1897	350,000
July 19, 1897	50,000
July 1, 1898	450,000
March 3, 1899	400,000
Total	$1,255,
Aggregate	2,187,

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y.	Jetty	Oct. 8, 1896	Dec. 7, 1896	On or before the expir of one year after the sum of money for w the Secretary of W authorized to enter contract under these s fications shall have appropriated.

COMMERCIAL STATISTICS.

Commerce of Fernandina, Fla., during the year ending December 31, 1898.

[Furnished by J. W. Howell, collector of customs.]

Articles.	Gross tonnage.	Estim valu
Fertilizers	504	$10
Lumber, rough	1,074,514	911
Lumber, dressed	12,600	151
Merchandise	4,800	240
Phosphate, rock	85,055	850
Phosphate, pebble	700	7
Vegetables	2,400	120
Railroad supplies	6,705	134
Total	1,187,278	2,42

Arrivals and departures of vessels for year ending December 31, 1898.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Ton
Steamers	71	104,173	71	104
Sailing vessels	176	75,400	198	96
Yachts	3	160	3	
Total	250	179,733	272	201

Estimated number of passengers carried by water, 500.
Probable increase of trade were improvements completed, 50 per cent.

P 2.

IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1305 to 1312, Report of the Chief of Engineers for 1896, and to pages 1586 to 1604, Report of the Chief of Engineers for 1895, the latter being a report upon a survey of St. Johns River, Florida, from Jacksonville to the ocean, with a view of securing a 24-foot channel, and to pages 1327 to 1330, Report of the Chief of Engineers for 1898.

Improvement at the entrance.—There has been no work done upon this portion of the improvement since November 25, 1897, and there has been very little change in the condition of the jetties since the annual report of 1898. A survey of the entrance was made in May and June, 1899, the map of which is presented herewith.

North jetty.—The longitudinal profiles of the jetties shown on this map, compared with those made from the survey of December, 1897, the last previous profiles taken, show that there has been a subsidence of the top of the north jetty of about 2 feet between Stations 3200 and 5300, of about 1 foot between Stations 5300 and 6200, about 3 feet between Stations 7600 and 7900, and an average of about 3 feet from Station 9000 to the outer end, at Station 10934, so that the condition of the north jetty is at present as follows: Between the inner end and Station 3000 the crest of the jetty gradually slopes from high to low water, excepting a sharp depression at Station 550, where it is 2½ feet below mean low water. At Station 3300 the crest is 3 feet below mean low water and averages about the same reference to Station 8400, excepting at Station 6700, where it rises to 1 foot above mean low water, and at Station 7,600, where it is 5 feet below mean low water. From Station 8400 to Station 9100 the crest slopes from 3 feet below mean low water to 8 feet below the same plane. From Station 9100 to Station 9700 the crest rises to 2 feet above mean low water, and from there to near the outer end, at Station 10934, it rises to 5 feet above mean low water.

South jetty.—There has been a subsidence of the crest of the south jetty between Stations 3800 and 5700 of an average of about 1½ feet, and of from 1 to 3 feet between Stations 7500 and 8200, leaving the present condition of the jetty about as follows: From the shore end to Station 7900 the height of the crest varies from 6 feet to 3 feet, averaging about 4½ feet above mean low water. From Station 7900 to near the outer end, at Station 10712, the crest slopes gradually from 3 feet above to 2 feet below mean low water.

The bar.—The survey made in May and June, 1899, shows that during the past year there has been an improvement in the general conditions obtaining in the channel across the bar. While the available depth is about the same—13½ feet at mean low water—the channel is much wider and the shoal much shorter. The width of the channel between the 12-foot contours is 800 feet, while last year it was only 150 feet. The distance between the inner and outer 15-foot contours is now 650 feet, with two places in excess of 15 feet between, while last year it was 1,800 feet. The bar has advanced seaward about 200 feet, so that the inner 15-foot contour is now beyond the outer end of the south jetty. The channel inside the bar shows a general improvement, being both wider and deeper, excepting the portion opposite Station 3000 of the south jetty. At this point the shoal on the north side has continued to encroach upon the channel, leaving a width of scant 500 feet between the shoal and the jetty.

There has been an additional volume of sand brought in over the north jetty and deposited between the jetties. This movement of sand will doubtless continue until the north jetty is built up throughout its entire length. Sand continues to accumulate along the south side of the south jetty from the shore out, but apparently none of this sand crosses the jetty now and it is beneficial, in that it adds to the stability and impermeability of the jetty.

The river above the mouth.—During the month of June, 1899, a survey of the river from the entrance to Dames Point was made, covering all that portion of the river which had been improved with funds provided by Duval County, Fla. This improvement consisted of building numerous dikes, training walls, and shore protection, and in dredging a channel 200 feet wide and 18 feet deep at mean low water. With the exception of a few breaks in the shore revetment at St. Johns Bluff the training walls, dikes, etc., are all in good condition. The dredged channel has shoaled in some places and deepened in others.

The shoaling in the channel near Mile Point, about 1½ miles above Mayport, has been very extensive. The channel has moved southward and is now entirely out of the dredged location. The available depth, however, has not decreased during the year. It is now 14 feet at mean low water, slightly more than last year. Along the line where dredging was done there are places where there is less than 11 feet. The channel through the shoal about 3 miles above Mayport and 1 mile below St. Johns Bluff has shoaled and changed its position also, and is now close along the submerged training wall, where the available depth is 15 feet. Along the lines where dredging was done there is less than 12½ feet in places. A slight shoaling has taken place at the lower end of Browns Creek Cut, about 7 miles above Mayport. The available depth there is 17½ feet.

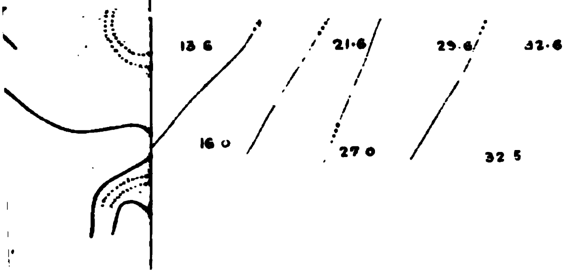
The upper end of Dames Point Cut, about 10 miles above Mayport, has also shoaled slightly. The available depth there is 17 feet. At a point near the lower end of Dames Point Cut there is slightly less than 18 feet at low water. This shoaling is no doubt due to the flattening of the side slopes, as the cutting was from 10 to 12 feet deep through that portion of the channel and the width of channel between the 12-foot contours now is in excess of 500 feet, where before there was only from 6 to 8 feet of depth at low water.

Elsewhere the dredged channel has maintained itself very well, and in places it has deepened materially.

The river and harbor act of March 3, 1899, appropriated $200,000 for continuing the improvement. It is proposed to apply this amount, together with the sum of $50,000 that had been reserved for dredging from the appropriation of June 3, 1896, to extending and building up the north jetty, and to dredging in the lower reaches of the river.

An advertisement inviting proposals for the jetty work was published on April 29, 1899, and bids were opened on May 31, 1899, all of which were rejected. The work will be readvertised in July. Proposals for the dredging contemplated will be invited at an early date.

The appropriation for the improvement of the St. Johns River, made in act of June 3, 1896, was expressed in these terms: "Improving St. Johns River, Florida, from Jacksonville to the ocean, in accordance with the project submitted February 27, 1895, $200,000." As mentioned above, $200,000 was also appropriated by the act of March 3, 1899.


13 6
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The project referred to in the act of June 3, 1896, is a project for obtaining 24 feet of water from Jacksonville to the ocean. The estimate that accompanied the project was for $2,109,750. Since the adoption of this project the officers in charge of this work have reported in each year's report that $500,000 could be profitably expended yearly. It has also been recommended that this work be put under the continuous contract system. The average yearly appropriation since the adoption of the project, far from reaching $500,000, has been less than $100,000. At this rate more than twenty-two years must elapse before the appropriations made will have reached the amount of the estimate. But it may be predicted with entire confidence that if the appropriations are made at this rate the work will be far from completed when the total amount shall have been appropriated.

It is again recommended that this work be put under the continuous contract system, or that at least $500,000 be appropriated yearly until the work is completed. The former would be the more economical and efficient plan.

Money statement.

July 1, 1898, balance unexpended	$51,908.11
Amount appropriated by river and harbor act approved March 3, 1899	200,000.00
	251,908.11
June 30, 1899, amount expended during fiscal year	3,564.13
July 1, 1899, balance unexpended	248,343.98
July 1, 1899, outstanding liabilities	220.81
July 1, 1899, balance available	248,123.17
Amount (estimated) required for completion of existing project	1,709,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

APPROPRIATIONS FOR IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

Under the original project the following appropriations were made for the work:

June 14, 1880	$125,000	
March 3, 1881	100,000	
August 2, 1882	150,000	
July 5, 1884	150,000	
August 5, 1886	150,000	
August 11, 1888	175,000	
September 19, 1890	170,000	
July 13, 1892	112,500	
March 3, 1893	284,500	
Total		$1,417,000

Under the existing project of improvement the following appropriations have been made:

June 3, 1896	$200,000	
March 3, 1899	200,000	
		400,000
Aggregate		1,817,000

Abstract of proposals for furnishing stone on jetties at mouth of St. Johns River, Florida, received and opened on May 31, 1899, in response to advertisement dated April 29, 1899.

Name and address of bidder.	20,000 tons first-class stone.		20,000 tons second-class stone.		20,000 tons third-class stone.		Total.
	Rate.	Amount.	Rate.	Amount.	Rate.	Amount.	
Chas. G. Smith & Son, Washington, D. C	$3.15	$63,000	$3.15	$63,000	$3.15	$63,000	$189,000
E. B. Grim, trading as Philadelphia Construction Co., Philadelphia, Pa	3.90	78,000	2.60	52,000	2.60	52,000	182,000
Geo. W. Eagan and Jas. H. Eagan, Charleston, S. C	2.52	50,400	2.47	49,400	2.18	43,600	143,400
W. K. Cornish and R. E. Randall, Birmingham, Ala	2.30	46,000	2.15	43,000	1.75	35,000	124,000
Edward H. Gaynor, Boston, Mass	2.33	46,600	2.33	46,600	2.11	42,200	135,400
Stewart Contracting Co., Columbia, S. C	2.53	50,600	2.23	44,600	2.23	44,600	139,800
Stockton & Bryan, Jacksonville, Fla	2.92	58,400	2.69	53,800	2.45	49,000	161,200
Roderick G. Ross, Jacksonville, Fla	2.62	52,400	2.52	50,400	2.22	44,400	147,200

All rejected.

COMMERCIAL STATISTICS.

Commerce of St. Johns River, Fla., during year ending December 31, 1898.

[Furnished by Jacksonville Board of Trade.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Merchandise	109,784	Brick	1,642
Lumber	224,279	Fertilizers	1,922
Shingles	75,094	Cement	315
Cross-ties	25,257	Cotton	375
Coal	31,555	Fish and oysters	1,211
Clay	18,341	Fruits	150
Vegetables	1,600		
Steel rails	1,449	Total	494,474
Iron	1,500		

Arrivals and departures of vessels for year ending December 31, 1898.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steam	194		193	
Sailing	235	418,340	247	421,287

Estimated number of passengers carried by water	326,695
Estimated percentage of total trade of neighborhood carried by water, per cent	60
Probable increase of trade were improvement completed ... per cent	100
Greatest draft of vessels ... feet	16½

P 3.

IMPROVEMENT OF ST. JOHNS RIVER AT ORANGE MILLS FLATS, FLORIDA.

By a resolution passed in May, 1898, Congress requested the Secretary of War to furnish information as to the condition of this locality with reference to navigation for ocean-going craft, and to submit an estimate of the cost of such improvement as might be necessary.

In response to this resolution a report was submitted by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, under date of May 30, 1898, and is printed on pages 1344 to 1348, Annual Report of the Chief of Engineers for 1898. This report contemplates the formation of a channel 200 feet wide and 13 feet deep at mean low water through the shoals between Jacksonville and Palatka, Fla., at an estimated cost of $120,000.

The river and harbor act approved March 3, 1899, adopted this project in the following words:

> Improving St. Johns River, Orange Mills Flats, Florida, in accordance with the approved project, $40,000.

Under this appropriation no work has as yet been done. It is proposed to make a survey of the shoals in order to determine the extent and location of the necessary dredging. Not exceeding $2,500 of this appropriation will be applied to this survey; the balance will be expended for dredging.

The sum of $80,000 could be profitably expended on this work during the fiscal year ending June 30, 1901.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$40,000.00
July 1, 1899, balance unexpended	40,000.00
Amount (estimated) required for completion of existing project	80,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	80,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriation for improvement of St. Johns River, Orange Mills Flats.

March 3, 1899	$40,000

COMMERCIAL STATISTICS.

Commerce of St. Johns River, Orange Mills Flats, Florida, during year ending December 31, 1898.

[Furnished by Board of Trade of Palatka, Fla.]

Articles.	Gross tonnage, estimated.	Estimated value.
Herbs	86	$8,750
Fertilizers	1,776	40,432
Lumber	8,122	497,343
Merchandise	8,796	242,975
Turpentine and rosin	2,000	200,000
Tobacco	15	24,000
Hay	898	13,475
Shingles	1,173	108,000
Sash, doors, and blinds	3,000	200,000
Total	25,866	1,330,975

Remarks.

The amount of business would have been much greater in line of lumber but for the fact that a large portion has to be lightered below Orange Mills Flats. As a consequence, much is diverted by rail to points north of here, where there is deep water. If the obstruction be removed lumber shipments will more than double in a very short time. W. A. Merryday states that he has only received two schooners during 1898, but, in anticipation of the obstruction at Orange Mills Flats being removed, he is about to organize a new line of sailing vessels direct to New York, and has just placed on the run the barkentine *Harry Merryday*, of 600 tons capacity and 14 feet draft. Owing to the shallow water at the "Flats" this boat can only bring up to Palatka 150 tons.

Arrivals and departures of vessels during year ending December 31, 1898.

The Clyde, Beach, and Miller lines give arrivals of steam vessels every day except Sunday, with large quantities of freight for points in the interior.

Probable increase of trade were improvement completed, 100 per cent.

Greatest draft of vessels, 10½ feet.

P 4.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to the Annual Report of the Chief of Engineers for 1897, page 1550, and for 1896, pages 1313 and 1314.

The river and harbor act approved March 3, 1899, appropriated $2,000 for maintenance. It was decided to expend this amount in repairing the two rows of fender piles previously constructed for the purpose of keeping vessels off the jetties and confining them to the channel. The U. S. dredge and snag boat *Suwanee*, with a hired crew, was used for this purpose. The boat arrived at Volusia Bar June 2. A pile-driver frame was constructed on the bow of the boat, and pile driving began June 8. Work was completed July 8, 1899

The work done consisted in removing the waling strips from the entire length of both rows, in driving new piles, and in attaching new waling strips. One thousand three hundred and sixty linear feet of waling strip was removed from the east row and 1,400 feet from the west row. Two hundred and ten piles were driven in all, 52 more than were previously in the work. There were driven in the east row 67 single piles, 22 double piles, and 2 clusters—one of 4 and the other of 5 piles. There were driven in the west row 80 single piles and 2 double piles; 5 clusters of 3 piles each and 1 cluster of 5 piles; 1,560 linear feet of 6 by 10 inch new waling strip was bolted onto each row. This was painted with carbolineum and then sheathed with 1-inch boards on the top and on the front side. This sheathing was given a coat of carbolineum, and all piles, after being sawed off, were capped with cement grout.

An appropriation of $2,000 is required each year to keep the bar in a navigable condition.

This work is in the collection district of St. Johns. Jacksonville is the nearest port of entry. Nearest light-house is Volusia Bar Light. Nearest fort is Fort Marion.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$2,000.00
June 30, 1899, amount expended during fiscal year	322.45
July 1, 1899, balance unexpended	1,677.55
July 1, 1899, outstanding liabilities	1,097.82
July 1, 1899, balance available	579.73
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriations for improvement and maintenance of Volusia Bar, Florida.

June 14, 1880	$5,000	July 13, 1892	$1,000
March 3, 1881	5,500	August 18, 1894	1,000
August 2, 1882	5,000	June 3, 1896	1,000
July 5, 1884	2,000	March 3, 1899	2,000
August 5, 1886	7,500		
August 11, 1888	500	Total	31,000
September 19, 1890	500		

COMMERCIAL STATISTICS.

Commerce of Volusia Bar, Florida, during year ending December 31, 1898.

[Furnished by Clyde's St. Johns River Line.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cattle	59	Oranges	405
Fertilizers	4,187	Pineapples	108
Fruits	523	Vegetables	2,126
Grain	3,708	Fish and oysters	194
Hides	23	Tobacco	114
Honey, sirup, etc	57	Hay	2,246
Lumber, rough	82		
Merchandise	8,127	Total	21,959

Arrivals and departures of vessels for year ending December 31, 1898.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	365	58,400	365	58,400

Estimated number of passengers carried by water	19,437
Estimated percentage of total trade of neighborhood carried by water, per cent	20
Probable increase of trade were improvement completed per cent..	200
Greatest draft of vessels feet..	6

P 5.

IMPROVEMENT OF OCKLAWAHA RIVER, FLORIDA.

For a description of the locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1314 to 1316, Report of the Chief of Engineers for 1896.

The river and harbor act of June 3, 1896, appropriated the sum of $3,000 for maintaining the improvement of this river, and it was decided to expend the amount available along that portion of the river already worked over, between the mouth of the river and the mouth of Silver Springs Run, by the removal of such snags and overhanging trees as had become obstructions during the cessation of work.

A circular letter soliciting proposals for furnishing a plant with which to do the work was issued January 15, and bids were opened on January 29, 1898. The lowest bid, $51 per day, was considered too high for the character of plant offered, and on February 4 authority was granted to do the work with the U. S. snagboat *Suwanee* as soon as her services should become available. During the war with Spain the *Suwanee* was made use of by the expeditionary forces of the United States, and went to Santiago, Cuba. This caused delay in commencing this work, especially as the boat had to be refitted and repaired at Tampa upon her return, and brought around from the Gulf coast. Consequently it was not until March 11, 1899, that actual operations were begun on the river.

The river and harbor act of March 3, 1899, appropriated $3,000 for this river for maintenance. It was decided to expend this amount in the same manner as the previous appropriation, on the portion of the river which had already undergone improvement.

Operations on the river were suspended May 31, 1899, all that portion of the river between the mouth and Silver Springs Run having been thoroughly cleared of obstructions to navigation. The *Suwanee* is the largest vessel that has up to this time navigated the stream, being 115 feet long and 28 feet beam over all. The boat needs repairs from the rough usage necessary on this work, and it is proposed to expend a portion of the balance remaining for this purpose.

During the progress of the work, March 11 to May 31, 1899, 901 snags, 360 overhanging trees, all over 2 feet in diameter at the butt, 104 stumps, 2 wrecks, 400 cubic yards of sand and mud, and 54 cubic yards of rock were removed from the river.

Logging operations are the great source of obstructions on this river, and unless some means are taken to stop the present practice, it will only be a short time before the river will become badly obstructed again. The matter has been brought to the attention of the Department of Justice, and it is hoped that the flagrant violations of the law involved in the present methods of constructing booms and rafts will cease. The logging business is the most considerable industry on this river, but is now conducted in such a way as to interfere with and obstruct other navigation and should be put under special regulations. In this connection attention is invited to the accompanying report of Mr. O. N. Bie, superintendent.

All of the appropriations since that made in act of September 19, 1890, have been for maintenance.

The sum of $15,000, still remaining unappropriated of the amount estimated to complete the existing project, in addition to $2,000 required for maintenance, could be profitably expended during the fiscal year ending June 30, 1901.

The Ocklawaha River is in the collection district of St. Johns. The nearest lighthouse is the St. Augustine Light. The nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1898, balance unexpended		$3,000.00
Amount appropriated by river and harbor act approved March 3, 1899		3,000.00
		6,000.00
June 30, 1899, amount expended during fiscal year		4,366.30
July 1, 1899, balance unexpended		1,633.70
July 1, 1899, outstanding liabilities		85.35
July 1, 1899, balance available		1,548.35
Amount (estimated) required for completion of existing project		15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$15,000.00	
For maintenance of improvement	2,000.00	
		17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations for improvement and maintenance of Ocklawaha River, Florida.

September 19, 1890	$10,000
July 13, 1892	1,000
August 18, 1894	3,000
June 3, 1896	3,000
March 3, 1899	3,000
Total	20,000

COMMERCIAL STATISTICS.

Commerce of Ocklawaha River, Florida, during year ending December 31, 1898.

[Furnished by R. J. Adams.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cotton and wool	1	Merchandise	540
Fertilizers	25	Ship stores	3,500
Fruits	4	Vegetables	20
Grain	261	Hay	100
Hides	1		
Honey, sirup, etc	17	Total	4,481
Lumber, rough and dressed	12		

Millions of feet of cypress and pine logs and cross-ties are taken out by different parties.

Arrivals and departures of vessels for year ending December 31, 1898.

	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	160	3,700	160	781

Estimated number of passengers carried by water, 9,000.

REPORT OF MR. O. N. BIE, SUPERINTENDENT.

U. S. Snag boat "Suwanee,"
May 17, 1899.

Colonel: I have the honor to submit the following report, in compliance with your order of February 20, regarding logging and rafting on the Ocklawaha River:

This river has its main source in the lakes in Lake County, and flows in a general northerly direction for a distance of 65 miles, then in an easterly direction for 20 miles, emptying into the St. Johns River near Welaka, about 105 miles above St. Johns Bar.

The upper 27 miles flows through prairies; the lower 58 miles through extensive cypress swamps, and its flow is augmented along its entire distance by numerous springs, including Silver Spring, the largest in Florida.

The river is very crooked and narrow, in some places less than 40 feet wide.

The different branches of business and their relative importance may be classed as follows:

	Per cent.
Fruit and vegetables	4
Naval stores	6
Passenger traffic	10
Export of lumber (cypress and pine)	80

Previous to the freeze of 1895 the fruit and vegetable business was extensive, but is now of but little importance.

There are seven small turpentine stills along the river, and the turpentine and resin are generally towed in small barges to Silver Springs and there forwarded by rail.

About three months in the year, January to March, inclusive, an extensive tourist travel is carried on between Palatka and Silver Springs, a line of passenger steamers making daily trips between those points, but from April to December there are but two small steamers, and they appear to be fully able to handle all the vegetable, naval stores, and passenger business.

Cutting and rafting timber has been carried on for many years, but it is only within the last four years that it has reached the proportions it now has. During the past four years about 13,000,000 feet of cypress and 4,000,000 feet of pine have been rafted yearly, and this year one lumber company at Palatka, which owns the greatest part of the cypress swamps along the river, has contracted with a party to supply them with 20,000,000 feet of cypress. Another party, who owns 14,000 acres of heavily-timbered pine land, expects to ship about 12,000,000 feet of pine logs per year for several years. Several others are engaged in logging on a smaller scale.

Cypress logs, delivered at the mouth of the Ocklawaha, are worth about $7, and pine logs $5 per 1,000 feet, B. M.

There are at present fourteen steam log pullers in the river and tributary creeks engaged in hauling cypress from the swamps. These log pullers are heavily built scows, with powerful engines and large friction drums, to which are attached endless steel cables from 1 to 2 miles along. The bight of the cables is taken into the swamp and run through a large block secured to a tree. When a tree is felled it is cut into two logs from 10 to 24 feet long; a large steel cone is placed over one end to prevent the log from catching stumps and fallen trees, and it is then attached to the endless cable and pulled into the river, where it is placed in a boom until a sufficient number of logs have been obtained to make a raft. Pine logs are generally hauled to the river by teams wherever the river skirts high banks. and then rolled into a boom and built into rafts. At one place (Gores Landing) a railroad has been lately built, about 4 miles long, from the landing to the pine woods. The logs are pulled to the railroad by steam engines and cables, loaded on the cars by steam, and hauled to the river by locomotives at the rate of from 40,000 to 50,000 feet per day, and dumped into a boom.

It frequently occurs that logs sink. either as soon as they get into the water or after having been in the water for some time. Such logs are generally taken up again and held in the rafts suspended by binders between floating logs, but a great number are carried by the current to some distance below the boom and are left in the river, forming bad obstructions.

Log booms consist of a number of logs chained together at the end and the two ends of the boom fastened to the river bank above and below where logs are rolled into the river. When the booms are filled with logs they often bulge out until they nearly touch the opposite bank.

At one place (Gores Landing) I have seen a passenger boat 22 feet wide trying to force its way between the boom and the opposite bank, and after a considerable difficulty and loss of time getting through it ran unavoidably on a raft immediately below the boom and had to cut loose several logs before it could get off. At another place, when passing with the U. S. snag boat *Suwanee*, which is at present engaged in removing obstructions on this river, several new cypress logs were seen on the shallow river bottom near a log boom. I stopped to remove them, but was informed by the foreman that he would take them up at once. This evidently was not done, as the steamer *Fearless* broke her propeller on a log at that place the next day and had to return to Palatka.

I have found pine log obstructions more numerous and also more dangerous than cypress logs. Pine rafts are more carelessly constructed, and a greater number of logs are consequently lost in rafting them to the mouth of the river. Some pine logs sink with but one end and the other floats near the surface, thus forming very dangerous snags.

Rafts are constructed in section from 30 to 50 feet long and about 35 feet wide. A section generally consists of four logs chained together, forming a square and filled with loose logs. If any logs are in danger of sinking, a binder is laid across the section and the heavy logs fastened to it by "dogs." A complete raft consists of from five to nine such sections connected behind each other by lines or yokes. On the outsides of each section are large logs extending several feet beyond the front corners of its following section; these are called "wing logs," and prevent the raft from catching on projecting stumps or trees. By building rafts in this manner they are able to pass around very sharp points, though they are often 500 feet long.

A rafter is paid a certain sum per raft to take it down to the mouth of the river, depending upon the distance it is carried. It is therefore to the interest of the owners to make them as large as possible. Long rafts are difficult to handle and when, as sometimes happens, the front end runs against a snag or point, the following sections swing athwart the river and form a jam. In order to open the jam several logs, and even whole sections, are often cut loose and left along the banks, or sunk in the river.

Complaints are made, and justly, that rafts, log booms, and sunken logs are making navigation difficult and dangerous and that new obstructions are daily sunk in the channel through carelessness of loggers.

On my trip to Volusia Bar last week I noticed several new snags in the lower river where about six weeks ago the United States snag boat had removed all obstructions. The steamer on which I traveled lost two blades off its propeller by hitting sunken logs, so we arrived at Welaka with but one blade on the hub. The Captain informed me that it was the third propeller he had broken in six weeks.

Regulations for making navigation safe and to prevent unnecessary obstructions of the river should be made and enforced by the State of Florida or United States, on the following points:

1. Size of rafts.
2. Construction of rafts.
3. Removing drift logs.
4. Size and location of log booms.

Extreme width of rafts should not exceed 20 feet, nor the length 200 feet. Every raft section should have two binders extending from side to side, to which every log, except the wing log, should be secured.

All logs should be plainly stamped with the owner's mark on both ends so that they could be identified if they are found loose and obstructing the river. A penalty should be imposed if sunken or partly sunken logs are not removed within a certain time, say thirty days, and part of the fine given to the informant.

When permission is granted for building a log boom its width should be regulated so as to leave a clear channel of not less than 40 feet in the straight parts and not less than 50 feet in the bend of the river for passing boats. Where log landings happen to be in a very narrow part of the river, the logs should be floated down to the boom in a wider place. Piles should be driven about 20 feet apart on the outer edge of the boom along the channel to prevent the boom from bulging when filled with logs.

Unless regulations are made on above point it would be useless for the United States to appropriate money for improving this river, but regulations would not avail unless arrangements were made for enforcing the same.

The most economical and effective plan for enforcing regulations would, perhaps, be to have a deputy United States marshal make monthly inspection and arrest infringers of such regulations.

Very respectfully, your obedient servant,

O. N. BIE, *Superintendent.*

Lieut. Col. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

P 6.

IMPROVEMENT OF ST. AUGUSTINE HARBOR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1316 and 1317, Report of the Chief of Engineers for 1896.

The amount appropriated by the river and harbor act of August 17, 1894, being inadequate to construct the new work designed, is still held in reserve for emergencies that may arise as a result of storms, or until additional appropriation is made. Some erosion of the shore line has occurred inside of the inner groin on the north side of the entrance, and in the neighborhood of the inner two groins on the south side.

There were no operations during the year ending June 30, 1899.

St. Augustine Harbor is in the collection district of St. Augustine, which is the nearest port of entry. Nearest fort is Fort Marion. The St. Augustine Light is the nearest light-house.

Money statement.

July 1, 1898, balance unexpended	$6,000.10
July 1, 1899, balance unexpended	6,000.10

Appropriations for improvement of St. Augustine Harbor, Florida.

August 11, 1888	$35,000
September 19, 1890	20,000
July 13, 1892	10,000
August 18, 1894	6,000
Total	71,000

COMMERCIAL STATISTICS.

From information furnished by Thomas B. George, collector of customs, there was no water commerce at this port during the year ending December 31, 1898.

P 7.

IMPROVEMENT OF INDIAN RIVER, FLORIDA.

(1) INDIAN RIVER, BETWEEN GOAT CREEK AND JUPITER INLET.

For a description of this locality, the requirements of commerce, the project adopted, the methods of improvement employed, the work accomplished, and its cost, attention is invited to the Report of the Chief of Engineers for 1896, pages 1318 to 1320.

No funds being available there was no work done on the river proper during the last fiscal year.

(2) NEGRO CUT.

For a description of locality, project, and work done, attention is invited to Reports of the Chief of Engineers for 1894, page 1227 et seq., and for 1896, pages 1318-1319.

The river and harbor act of June 3, 1896, contained the following item:

> Improving Indian River, Florida, by dredging channel at Negro Cut, near Indian River Inlet, seven thousand five hundred dollars.

In submitting the estimate for this improvement the cost of the training wall to protect the dredged channel was included. It will be noticed that the item of the act quoted above provides for dredging only.

The channel called for by the project had already been dredged to its full dimensions, consequently no material amount of dredging was required, but a training wall, as contemplated in the project, was considered essential for its protection. It having been decided that the money available could not be used for the construction of the training wall, no project was adopted for its expenditure.

The river and harbor act of March 3, 1899, contained the following item:

> Improving Indian River, Florida: By dredging channel at Negro Cut, near Indian River Inlet, five thousand dollars; and the unexpended balance of the amount heretofore appropriated may be expended in the construction of training wall or piling for the protection of the dredged channel.

Some shoaling has taken place in the dredged channel where protection is needed from the cross currents flowing along the line of the crooked old channel. It is proposed to remove these shoal places and to construct the training wall of palmetto piles, brush, and stone, with the dredged material deposited over it wherever practicable.

It is proposed to do this work by hired labor, using the United States dredge and snag boat *Suwanee*, or the new boat, the construction of which was authorized by the act of March 3, 1899, as may be most convenient and expeditious, the necessary material to be purchased after due advertisement by circular letter. No work has yet been done, as the *Suwanee* has been engaged upon other work and the new boat has not been constructed.

It is estimated that an appropriation of $1,000 annually, or $2,000 biennially, will be required to maintain this channel.

(3) JUPITER INLET.

The work at Jupiter Inlet is completed. For description see Report of Chief of Engineers for 1897, page 1554.

The improvement of Indian River between Goat Creek and Jupiter Inlet is of sufficient importance to warrant its early completion. The balance, $29,000, of the estimate for completing the project could be profitably expended during the fiscal year ending June 30, 1901.

Money statements.

INDIAN RIVER, BETWEEN GOAT CREEK AND JUPITER INLET.

Amount (estimated) required for completion of existing project	$29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	29,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

NEGRO CUT, INDIAN RIVER INLET.

July 1, 1898, balance unexpended	$7,820.47
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
July 1, 1899, balance unexpended	12,820.47

Appropriations for improvement of Indian River, Florida.

July 13, 1892 (between Goat Creek and Jupiter Inlet)	$15,000
August 18, 1894 (Negro Cut)	5,000
March 2, 1895 (Negro Cut)	15,000
February 26, 1896 (Jupiter Inlet)	500
June 3, 1896 (Negro Cut)	7,500
March 3, 1899 (Negro Cut)	5,000
Total	48,000

COMMERCIAL STATISTICS.

No commercial statistics for this river are given. Persons interested in the matter were requested to furnish them, but they have not done so.

P 8.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

[This work was in the charge of Captain McKinstry the entire year.]

For a description of this locality, the requirements of commerce, an account of early attempts at improvement, present project, methods used, work accomplished on east jetty, cost, and results obtained, see pages 1325-1327, Report of Chief of Engineers for 1896. For an account of commencement of work on west jetty, see page 1371, Report of the Chief of Engineers for 1898.

The act of June 3, 1896, contained the following provision:

> Improving entrance to harbor at Key West, Florida: Continuing improvement, eighty thousand dollars.

The project for the expenditure of this sum was approved by the Department March 24, 1897. After due advertisement, bids for doing the proposed work by contract were opened June 4, 1897. The bid of R. G. Ross, of Jacksonville, Fla., at $1.57 per ton, was the lowest and was accepted.

Work under this contract was begun about December 1, 1897. On June 2, 1898, work was suspended by authority of the Secretary of War, at the request of the contractor, during the continuance of hostilities with Spain. Work was resumed October 6, 1898, and the contract completed June 9, 1899. To June 30, 1898, 14,980.1 tons of stone had been deposited under the contract. On October 1, 1898, the time for completing the contract was extended until May 1, 1899. On April 13, 1899, it was again extended sixty days from May 1. During the fiscal year 28,416.5 tons of stone were deposited, making a total of 43,396.6 tons under the contract.

The tracing herewith shows the condition of the bar and of the jetties as shown by the survey made April 18 to 21, 1899. From this it appears that shoaling has taken place over the entire bar area. There is a safe channel across the bar 10.5 feet deep at mean low water.

The approved project for the jetty under construction contemplates a structure the foundation and hearting of which is to consist of coral limestone of the vicinity and of a capping of heavy granite blocks. The work accomplished under the contract which was terminated June 9, 1899, completes the foundation and hearting from Station 1300 to Station 5900.

The act of March 3, 1899, contained the following provision:

> Improving entrance to Key West Harbor, Florida: Continuing improvement, twenty-five thousand dollars.

A project for the expenditure of this sum—in substance, the extension of the foundation and hearting of the west jetty to the south—was submitted April 15, 1899, and approved April 25, 1899. The project involved the performance of the work by contract. Bids were opened June 29, 1899.

The northwest channel is of great importance, affording as it will, when the project for its improvement is completed, a short cut for deep draft vessels entering and departing from Key West. The work should be pushed forward as rapidly as possible, and, with this end in view, it is recommended that $200,000 be made available for the work during the fiscal year ending June 30, 1901.

The harbor at Key West is in the collection district of Key West, Fla., which is the nearest port of entry. Nearest light-house is the Northwest Passage Light. Nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1898, balance unexpended	$50,593.95
Amount appropriated by river and harbor act approved March 3, 1899	25,000.00
	75,593.95
June 30, 1899, amount expended during fiscal year	50,301.94
July 1, 1899, balance unexpended	25,292.01
July 1, 1899, outstanding liabilities	175.00
July 1, 1899, balance available	25,117.01
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of northwest entrance, Key West Harbor, Florida.

August 2, 1882	$25,000
August 5, 1886 (survey)	2,500
August 11, 1888	25,000
September 19, 1890	40,000
July 13, 1892	75,000
August 18, 1894	$80,000
June 3, 1896	80,000
March 3, 1899	25,000
Total	352,500

Abstract of proposals for furnishing stone on west jetty at northwest entrance to harbor at Key West, Fla., received and opened on June 29, 1899, in response to advertisement dated May 29, 1899.

Name and address of bidder.	15,000 tons stone.		Remarks.
	Rate.	Amount.	
Roderick G. Ross, Jacksonville, Fla	$2.17	$32,550.00	The amount of funds available will permit of entering into contract for about 10,600 tons.

Contract in force during fiscal year.

Name of contractor.	Contract.	Date approved.	Date of beginning of work.	Date of expiration (as extended).
Roderick G. Ross	Jetty construction	July 8, 1897	Aug. 15, 1897	June 30, 1899

Work was suspended from June 2, 1898, to October 6, 1898, during continuance of hostilities with Spain.

COMMERCIAL STATISTICS.

Commerce of Key West, Fla., during year ending December 31, 1898.

[Compiled from information furnished by the Mallory, Plant, and East Coast Steamship lines, and by Wm. Curry's Sons, Cash & Curry, and N. O. Benner & Co., of Key West, Fla.]

Articles.	Gross tonnage (estimated).	Value (estimated).
Cigars	488	$4,320,000
Fish and oysters	741	17,023
Fruits	2,178	52,895
Grain	4,011	115,160
Hides	297	15,135
Merchandise	58,986	5,995,724
Pineapples	1,200	22,000
Ship stores	1,300	161,000
Sponges	157	486,977
Tobacco	620	623,000
Vegetables	2,990	194,090
Total	72,968	12,003,004

Arrivals and departures of vessels at port of Key West, Fla., during year ending December 31, 1898.

[Furnished by collector of customs.]

Kind of vessels.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	527	421,797	490	372,669
Sailing vessels	330	102,900	306	72,137

Value of imports during 1898	$214,413
Value of exports during 1898	769,205

Estimated number of passengers carried by water, 17,988.

The regular transportation lines in operation during the year were the Plant Steamship Line, which ran three steamers per week between Tampa, Havana, and Key West; the Florida East Coast Steamship Line, which ran three steamers per week between Miami and Key West; the Mallory Line, running steamers between New York and Galveston, one of which stopped weekly at Key West; and the Morgan Line, running between New Orleans and Havana, one steamer per week stopping at Key West. These lines partly suspended operations during the continuance of the war with Spain.

P 9.

REMOVING THE WATER HYACINTH FROM FLORIDA WATERS.

Under the provisions of the sundry civil act approved June 4, 1897, a board of officers, consisting of Lieut. Col. W. H. H. Benyaurd and Maj. James B. Quinn, Corps of Engineers, was appointed to investigate the extent of the obstruction to the navigable waters of Florida, Louisiana, and other South Atlantic and Gulf States by the aquatic plant known as the water hyacinth, and to perform such experimental work as might be deemed necessary to determine a feasible plan or method of checking or removing such obstruction.

The report of this board, submitted under date of November 30, 1898, is printed in House Doc. No. 91, Fifty-fifth Congress, third session. The board recommended the construction of two boats, one for use in Florida and the other in Louisiana. The board also favorably considered the use of log booms as an adjunct to the operation of the steamers.

The river and harbor act approved March 3, 1899, contained the following item:

> The sum of $25,000, or so much thereof as may be necessary, is hereby appropriated, to be expended under the direction of the Secretary of War, for the construction of a boat suitable for operating on the navigable streams of the State of Florida, in removing therefrom the aquatic plant known as the water hyacinth, so far as it is an obstruction and hindrance to interstate or foreign commerce; also $1,000 for log booms, to be used as adjuncts to such steamer, and $10,000 for conducting the necessary operations, making $36,000 in all, according to the estimate and recommendation of the War Department, as found in House Document Number Ninety-one, Fifty-fifth Congress, third session.

Under this provision it is proposed to design a suitable boat and have same built by contract. Nothing has, as yet, been done on this work.

It is estimated that the sum of $10,000 will be required for operating expenses of this boat during the fiscal year ending June 30, 1901.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$36,000.00
July 1, 1899, balance unexpended	36,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	10,000.00

Appropriations for removing the water hyacinth, Florida.

March 3, 1899:	
For construction of boat	$25,000
For log booms	1,000
For operating expenses	10,000
Total	36,000

P 10.

DREDGE FOR RIVER AND HARBOR IMPROVEMENTS, FLORIDA.

The river and harbor act approved March 3, 1899, contained the following item:

> The sum of thirty-five thousand dollars, or so much thereof as may be necessary, is hereby appropriated, to be expended, in the discretion of the Secretary of War, in the purchase or construction of a suitable dredge, with snagging outfit, to be used in connection with the several works of river and harbor improvement on the coast of Florida and the waters tributary thereto.

Under this provision it is proposed to design a steel hull, stern wheel, combined dredge and snag boat about 115 feet long, 28 feet beam, and 7 feet depth, to be driven by a 200-horsepower engine and to be fitted with dredging machinery consisting of a 2-yard clam shell and a 12-inch centrifugal pump; also snagging appliances adapted for use with the dredging machinery. Some preliminary work has been done on the plans for the boat. When the plans and specifications are completed it is proposed to invite proposals for construction and to let contract therefor if a satisfactory proposal is received.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$35,000.00
July 1, 1899, balance unexpended and available	35,000.00

P 11.

INVESTIGATION OF THE EXTENT OF THE OBSTRUCTION OF THE NAVIGABLE WATERS OF FLORIDA, LOUISIANA, AND OTHER SOUTH ATLANTIC AND GULF STATES BY THE AQUATIC PLANT KNOWN AS THE WATER HYACINTH.

[Printed in House Doc. No. 91, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 14, 1898.

SIR: The sundry civil act approved June 4, 1897, provides as follows:

> That the Secretary of War be, and he is hereby, authorized to investigate the extent of the obstruction of the navigable waters of Florida, Louisiana, and other South Atlantic and Gulf States by the aquatic plant known as the water hyacinth, and to perform such experimental work as he shall deem necessary to determine some suitable and feasible plan or method of checking and removing such obstacle, so far as it is a hindrance to interstate or foreign commerce, and to report the results of such investigation and experimental work; and the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay the cost thereof.

For the purpose of considering the question demanding attention under this provision of law, a Board of Officers consisting of Lieut. Col. W. H. H. Benyaurd and Maj. James B. Quinn, Corps of Engineers, was constituted, by authority of the Secretary of War, to give the matter such consideration as was possible with the limited funds provided, and I have now the honor to submit the accompanying copy of report, dated November 30, 1898, with map[1] and two photographs[1] by the Board upon the subject.

It is stated in the report that the map submitted, which shows the St. Johns River from Jacksonville to Lake Washington, covers almost the entire area of the territory in the State of Florida mainly affected by the plant, so far as the navigability of the streams is concerned. Its existence in many smaller lakes, ponds, and streams has not been considered by the Board for the reason that such consideration would have no particular bearing upon the question at issue. In Louisiana the plant is found in nearly all the streams, lakes, bays, and bayous connecting with the Gulf in the portion south of the latitude of Baton Rouge, extending from the eastern parishes westward to the Sabine River. So far as is known, the hyacinth in no way affects the streams in Georgia or Alabama, or even those in western Florida. It is therefore assumed that its growth is confined to Florida and Louisiana, and to these States the Board has confined its attention.

A series of experiments, both chemical and mechanical, was conducted in the heart of the infected district in Florida, with a view to the destruction of the plant, and consideration was also given to the subject of utilizing nature to effect the desired result by the introduction of some animal or parasitic growth.

Reviewing the results of the experiments and investigations conducted, the Board is of opinion—

1. That an attempt to utilize nature for the destruction of the plant is not desirable.

2. That the action of the chemicals experimented with does not offer any solution of the problem. In this connection reference is made to the successful experiments of Assistant Engineer P. H. Thomson, of Plaquemine, La., with a saturated solution of salt, with enough quicklime added to make a good spraying mixture. The cost of this method, estimated at about 2 cents per square yard, would, however, make its use over an area of many thousand acres a very expensive undertaking.

3. That while it is beyond the limit of probability that the plant can be entirely eradicated by mechanical means, there is no doubt that the condition of affairs can be greatly ameliorated by active measures in that line. Of the methods suggested, that of crushing appears to be the best. In all measures, however, that might be considered for clearing the streams of the obstruction, the point should not be overlooked that all bridges should have suitable spans or openings to allow a free passage of all floating masses of the weed.

The details of construction of suitable boats for operating on the streams have been duly considered, and it is recommended by the Board that two boats be built, one for Florida and the other for Louisiana, at a cost of about $25,000 each. The use of log booms as an adjunct to the operation of the steamers is favorably considered by the Board, the cost of their construction being placed at $1,000. In addition to these amounts an appropriation of $10,000 for each district is deemed necessary for conducting operations. Annual appropriations will also be needed, for which provision can be made in the future, in the light of experience gained in the proposed operations.

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[1] Not reprinted. Printed in House Doc. No. 91, Fifty-fifth Congress, third session.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

HON. R. A. ALGER,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., November 30, 1898.

GENERAL: The Board of Engineer Officers constituted by Special Orders, No. 18, Headquarters Corps of Engineers, Washington, June 19, 1897, to investigate the water hyacinth question in the States of Florida and Louisiana, has the honor to submit the following report:

The act of Congress constituting the Board, and which defined the scope of its duties, is as follows:

> That the Secretary of War be, and he is hereby, authorized to investigate the extent of the obstruction of the navigable waters of Florida, Louisiana, and other South Atlantic and Gulf States by the aquatic plant known as the water hyacinth, and to perform such experimental work as he shall deem necessary to determine some suitable and feasible plan or method of checking and removing such obstacle, so far as it is a hindrance to interstate or foreign commerce, and to report the results of such investigation and experimental work; and the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay the cost thereof.

The Board met at St. Augustine September 5, 1897, and entered upon its duties. The water hyacinth, its propagation, growth, spread, and the tendency thereof, if not checked, to eventually destroy the navigability of the streams involved, has been the subject of former investigation and reports, not only by officers of the War Department, but by the Department of Agriculture. Documents that were on the files of the Department, various other papers, letters, newspaper clippings, and expressions of opinion from interested parties were read and duly considered. With all the information derived from the above-enumerated sources of information, it may fairly be assumed that there was but little other literature, either published or which could otherwise be made available, that would throw any great amount of additional light on the vexed question so far as it related to the plant in Florida and as to suggested means that should be adopted, either for the actual extinction of the plant or for an amelioration of existing conditions, with a view to restoring, or at least maintaining to some extent, the navigability of the affected streams. With the information before the Board a general plan was outlined to carry on examinations on certain lines. As Mr. J. W. Sackett, assistant engineer, attached to the United States engineer office at St. Augustine, had been engaged under former instructions to institute certain investigations, the Board availed itself of his services to carry out its views. His report on various matters of interest regarding the question is appended.

There is likewise attached to the report herewith a general outline map (in two sheets) of the Upper St. Johns River and connecting lakes, which cover almost the entire area of the territory in the State of Florida mainly affected by the plant—that is, so far as the navigability of the streams is concerned. There are otherwise many smaller lakes, ponds, and streams in which the plant is found in abundance, but which, having no particular bearing upon the question at issue, are not taken into consideration.

In Louisiana the plant is found in nearly all the streams, lakes, bays, and bayous in the southern part of the State, about south of the latitude of Baton Rouge, which, either by themselves or through their connection with other streams, empty into the Gulf. The affected area extends from the eastern parishes of the State to the Sabine River on the west.

It might here be stated that so far as is now known the western streams of Florida, flowing into the Gulf of Mexico, do not appear to be affected, and further inquiries made of engineer officers in charge of improvements of rivers and harbors in western Florida, Georgia, and Alabama fail to elicit any information that the streams in these districts are in any way affected by the hyacinth. In fact, it is stated that the plant does not exist in any of the rivers in these districts. It may therefore be assumed that in general its growth is confined to Florida and Louisiana, and to these States the Board confined its attention.

The conditions of affairs as affecting the navigability of the streams in both of these States has been the subject of former reports to Congress and to the Departments engaged in the investigation of the question. Reference to these reports will be made hereafter.

As to the plant itself, under investigations made by the Department of Agriculture and reported upon by Mr. Herbert J. Webber, the following description of the hyacinth is here inserted:

> The water hyacinth is a native of tropical South America. It has clusters of light-blue or violet flowers, and blooms freely, and this has led to its being widely cultivated in Europe and America. In tropical and subtropical America, according to Schonland, it is a common and widely distributed weed. The plant is aquatic and commonly floats on the surface of the water without attachment to the soil. If the water is shallow, however, the roots may grow into the soft mud and become firmly attached. In many places on the banks of the St. Johns River the plants may be found growing on the muddy, marshy banks, where the roots have a firm attachment to the soil. If the plants are to succeed, however, the soil must be thoroughly saturated with water and of a loose texture. Even under such conditions they are evidently not entirely suited, as they do not grow as large as when floating. If the soil becomes comparatively dry, the plants die. The leaves of the water hyacinth form a rosette from 1 to 2 feet high. This remains above the water as the plant floats. The basal portions of the leaf stalks of the young plants are strongly swollen. As the plant becomes older these swellings gradually disappear and the petiole lengthens and becomes of nearly equal thickness throughout, or gradually tapers from the base to the leaf blade. The swellings on the petioles on the young leaves act as air reservoirs. In this way they insure the stability of the young plant, keeping it from sinking and preventing it from being overturned by wind or waves. Old plants become so thoroughly entangled that they can be torn apart only with considerable difficulty, and are in no danger of being overturned. Their long petioles are provided with large air chambers, which probably contain more air than the swollen leaf stems of the young plant. The roots form a dense, bushy mass, in many cases reaching a length of over 2 feet.

In further explanation of the peculiarities of the plant, Mr. Sackett, in his letter[1] to Lieutenant-Colonel Benyaurd, under date of September 9, 1896, when referring to the obstruction to navigation of the St. Johns River at Palatka, due to the accumulation of the plant in the river by the bridge of the Florida East Coast Railway Company, wrote as follows:

> The plant forming the obstruction is known to science under the name *Eichhornia crassipes* or *Pontederia crassipes*. It is similar in appearance to the common pickerel

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[1] Not received.

weed, generally known in the South as wampee. Instead of the heart-shaped leaf of the wampee, however, its leaves are broad, lance-shaped, nearly circular. The stems of the leaves are generally enlarged, at the water surface and just above, into curious oval bulbs filled with air cells, which evidently serve the double purpose of adding buoyancy to the plant and strength to the stems. These bulbs are more pronounced when the plant is growing singly or in small groups. In large masses of the plant the enlargement of the leaf stems is hardly apparent. The leaves attain a height of from 1 to 4 feet above the water, the largest plants being found in the large groups. The flower is very showy, being of a lilac-rose color with a yellow spot on the uppermost petal. The individual flowers are about 1¼ inches in diameter. They are formed on the central stem in the shape of a spike about 5 inches in length. The roots are numerous and have a central wire-like stem, from all sides of which feathery filaments project from one-half to 1 inch in length. The roots vary in length from 6 inches to 2 feet, depending upon the size of the plant. The flower is perfect and the plant is no doubt propagated from the seed. A noticeable peculiarity is that as soon as the flower fades the stem bends sharply over in the middle, immersing the seed pods. The plant is also propagated by runners starting from the crown just beneath the water surface. At a distance of about 6 inches a new plant begins to grow. Each new plant gives forth another runner. In this manner large masses of the plant grow together and remain intact as they drift about from place to place. The following are extracts from a communication emanating from the United States Department of Agriculture in reference to this plant:

"It is a native of Venezuela and was introduced into this country as an ornamental plant many years ago. In the Southern States it escapes from cultivation easily, and during the past five years has become so abundant in southern Louisiana and in the St. Johns River region of Florida that it seriously interferes with drainage, and in some cases with navigation. * * *

"This Department has made no experiments with its eradication, and there seems to be no other method of procedure than to remove the plant periodically by cutting and raking, precisely as it has been found necessary to do in Northern canals with *Udora canadensis* and other weeds."

The manner in which the plant had been introduced into the States where navigable streams are now so vitally affected has been a source of endless discussion and, naturally, a great divergence of opinion.

In Florida, it has been stated and very generally believed that the plant was introduced from Europe some seven or eight years ago and planted in a small pond near Palatka. Here it flourished to such an extent that it became necessary to find means to have it disposed of. The plants were taken from the pond and thrown, as stated, into the river. This action, it is asserted, was the inception of the serious condition of affairs now existing. This condition was further supplemented by the extraordinary growth of the plant, due to its methods of propagation. Various other opinions prevail as to its initial distribution throughout the St. Johns Basin. So far as observation goes, the plant itself appears to be mainly confined to the St. Johns, its connecting lakes, and minor tributaries, with the exceptions previously noted. While it may probably be a fact that the plant was introduced from Europe and found a foothold in Florida, other opinions have been given that years ago the hyacinth was known on the Lower St. Johns. It is further stated that the extensive marsh between Lake Harney and the source of the river is, and has been for years, the hiding place and nursery of the plant, and that before the construction of the canal connecting Lakes Tohopekaliga, Kissimmee, and Okeechobee with the waters leading to the Gulf of Mexico, the region was periodically flushed by the watershed, and all floating vegetable matter and débris was carried down the main channel. This kept the river free from all accumulation of the plant.

Whether indigenous or imported, the fact appears to remain that the plant grows in profusion in the upper regions of the St. Johns, and under certain conditions of rainfall and flow it may be carried on and make its appearance in sections below. While many of the smaller streams are congested, due to the action of winds forcing floating masses of the weed into them from the main river, it would appear improbable that in the last seven or eight years the weed would have wended its way some hundred or more miles upstream and have spread over thousands of acres. Cattlemen have carried the plant upstream for propagation and for growth as food for their animals, but it is not thought that this has been to such an extent as to have caused the widespread growth of the pest. Nor does the statement of its importation from any foreign country account for its growth and spread over the entire lower sections of Louisiana, upon streams widely separated and which are, in many instances, not connected. Some of the main streams and other bodies of water now affected in that State may be enumerated, though the list does not comprise all in which the plant has made its appearance. The rivers are Sabine, Calcasieu, Mermentau, Atchafalaya, Grand Amite, Tangipahoa, Chefuncte, Tickfaw The bayous are Vermilion, Teche, Plaquemine, Grossetete, Barataria, Manchac. The lakes are Grand, Chicot, Pontchartrain, Manchac. The bays are Vermilion and Cote Blanche.

No definite statement has been made as to the length of time that the streams in Louisiana have been affected. It may be stated, however, that one of the members of the Board, when in charge of certain river and harbor improvements in the State some twenty years ago, had the plant and its peculiarities described, and it is believed that it was then flourishing in the Atchafalaya. This was before the year stated as to its first appearance in Florida.

As to the condition of the streams where navigability and business interests have been endangered by the plant, reference can be made to the report of Mr. Sackett.

In Florida the accompanying photographs show vast accumulation of the plant at certain localities. In Louisiana reference has already been made to various streams or other bodies of water in which the hyacinth abounds. In this latter State practically all the bayous in the southern part are badly infested. The Vermilion is entirely blocked from the mouth up for a distance of 17 miles. Bayou Black, Blue Bayou, and Bayou Leopold are apparently entirely closed. In Bayou Teche serious obstructions exist. Even in the drainage and other canals in the vicinity of New Orleans contracts have to be made to keep the channels clear.

In Florida the main channel of the St. Johns is affected to a greater or less degree, while many of the smaller channels are completely blocked. The prevailing condition of affairs has been so frequently presented that it is not deemed necessary to reiterate the same in this report. Reference in regard thereto can be made to the reports of Mr. Sackett, assistant engineer, and Mr. Webber, of the Department of Agriculture. Still, these conditions, as presented, are changeable, due to climatic or meteorological influences. Then, it was noticed last spring, in the southern sections of the St. Johns, the plant had apparently disappeared, or at least had appeared to lose life, and the hope was expressed, and it was confidently believed, that the pest was disappearing; but with the advent of the rainy season it appeared in as great a profusion in many localities as before.

That the hyacinth has been and will continue to be a serious menace to the commerce of the streams in which is has a foothold (and with its spread may obtain a foothold in others) is beyond doubt, and some efforts should be made to afford some degree of relief to the many industries that are suffering from the accumulation of the plant in the streams. That these accumulations at many points are due to the structure and floating nature of the weed, which, under the action of currents, winds, and other influences, finds lodgment in the bends and other points of the stream, is beyond doubt. These are natural causes. In many other instances wharves, piers, log booms, and indifferent bridge construction are accountable for the blockade of commerce. Of the photographs that have been submitted to the Department no other better illustrates what is supposed to be the existing condition of affairs than that of the bridge at Palatka, where three small steamers are shown attempting to make their way through a mass of hyacinths. This is a particularly special case and can not be regarded as a representation of existing conditions, though, as is known and has been particularly stated, many other serious natural obstructions have been found to exist. Great stress has been placed upon the conditions shown by the photograph as illustrating the general harmful effects of the plant on navigation; whereas, as stated, it is a special case, and has heretofore been a subject of investigation by Congress. The blockade was not so much due to natural causes as it was to the peculiar constructive features of the lower bridge trusses which prevented a free flow of the masses of hyacinths. On this matter reference can be made to Senate Doc. No. 36, Fifty-fourth Congress, second session.

Were all bridges, piers, wharves, and similar constructions so built as to allow a free flow of the water, the difficulties attending navigation in the larger streams would be greatly diminished, and in some instances, entirely obliterated.

Various suggestions and plans for the destruction of the plant have been received and considered. These may be divided into three classes, viz, mechanical, chemical, and natural. On this matter a series of experiments, chemical and mechanical, were conducted at St. Francis, on the St. Johns, about 20 miles above Sanford, in the heart of the infested district of Florida.

Of the mechanical methods suggested there were two that were deemed worthy of consideration, viz, the crushing of the plant between heavy rollers, and further, the gathering of large masses and towing them to some locality where they could be otherwise destroyed. On this latter point it appears to be an established fact that such action destroys the plant, and, therefore, one of the suggestions was to tow the plant to sea. In the St. Johns this is hardly considered a practical idea. On many of the lower bayous and bays of Louisiana it might be done.

In Lake Ponchartrain, where the water is brackish, the hyacinth is not killed. The plants which floated out of Bayou Vermilion revived after they were carried back into the bayou if they had not been in salt water over twenty-four hours. Slightly brackish water apparently does not interfere with the growth. Sea water undoubtedly kills the pest after a short immersion, but they are capable of revivification when placed in fresh water if their immersion has not been sufficiently prolonged in salt water. They certainly possess great vitality, and if it should be considered desirable to tow them out to sea or into salt water, suitable arrangements would have to be made to prevent their return or to hold them back for at least twenty-four hours.

For experimenting on the crushing process masses of the plant were passed through the rollers of a planing machine, resulting in the extraction of about 60 per cent in moisture of their bulk. These crushed plants when set in a barrel of river water sunk in the ground were found to float on the surface of the water. At the expiration of thirty days the plants were a rotten mass, no signs of life having been observed since the crushing process. Some of the crushed plants piled up on land were dry enough to burn in thirty days. Large nets of very heavy cord were constructed. With the aid of tugs masses of the floating plants were encompassed and efforts were made to tow them to favorable location for destruction. When any heavy strain was placed on the tow lines the weeds were found to crowd over the net, and after several attempts the experiment was given up. For a detailed account of this attention is respectfully invited to accompanying report of Mr. Sackett, assistant engineer.

Various suggestions have been considered as to collecting the plants by means of log booms so arranged as to admit of the free passage of the plants down stream, but checking any attempt at progress up stream. Unless used in conjunction with some mechanical means of destroying the plant, this, at the best, would be but a palliative measure.

The following experiments were made to discover the action of various chemicals on the life of the plant:

1. An area of plants was sprayed with one quart 50 per cent solution commercial muriatic acid. The tops of the plants died in an hour, but the bulbs and roots showed no change, and after thirty days had put on a new growth nearly as high as before treatment by the acid.

2. An experiment similar to the above, but using a 100 per cent solution of the acid was no more successful as to the bulbs and roots, but the tops were killed at once.

3. A plant selected from a mass was treated to a jet of steam and hot water at 70 pounds pressure, but, while the top was killed, the bulb appeared uninjured, and after a while a new growth started.

4. An area of the plants was sprayed with a solution of 50 per cent commercial sulphuric acid.

5. An area of the plants was sprayed with a solution of 100 per cent commercial sulphuric acid.

6. An area of the plants was sprayed with a solution of crude carbolic acid.

The results of 4, 5, and 6 were the destruction of the tops only and no apparent injury to the roots, which sprouted and grew as well as in experiment No. 1.

7. An area of the plants was sprayed with kerosene, the result being that the plants were uninjured and continued to grow. An effort was made to burn the plant, using paper saturated with kerosene; but this was unsuccessful.

The idea of pitting nature against herself by the introduction of some animal or parasitic growth injurious to the plant is not, in the light of precedent, considered a safe or advisable experiment to undertake. The English sparrow, the rabbit in Australia, and the introduction of the Australian lady bug in California to kill the white scale on the orange trees are notable instances of the undesirability attending the carrying out of such experiments.

Reviewing the results of the experiments and investigations conducted, the Board is of opinion: (1) That an attempt to utilize nature for the destruction of the plant is not desirable. (2) That the action of the chemicals experimented with does not offer any solution of the problem. In this connection, however, Mr. P. H. Thomson, assistant engineer, of Plaquemine, La., has experimented with a saturated solution of salt with enough quick lime added to make a good spraying mixture and found it fatal to the plant, destroying the roots and tops in forty-eight hours. The cost of this, however, which is estimated at about 2 cents per square yard, would make the use of it over an area of many thousands of acres a very expensive undertaking.

While it is beyond the limit of probability that the plant can be entirely eradicated by mechanical means, there is no doubt but that the condition of affairs can be greatly ameliorated by active measures in that line. Of the means suggested, that of crushing appears to be the best. It has been shown by experiment that after crushing, the plant is lifeless and is also buoyant. This latter feature may, to some extent, in favored localities, be taken advantage of to allow the plant to be thrown back into the water and allowed to float to sea with the current. In all measures, however, that might be considered for clearing the streams of the obstruction, the point should not be overlooked that all bridges should have suitable spans or openings to allow a free passage of all floating masses of the weed.

The details of construction of suitable boats for operating on the streams have been duly considered, and it is recommended that two boats be built, one for Florida and the other for Louisiana, at a cost of of about $25,000 each. As an adjunct to the operation of the steamers, log booms for checking the movement of the masses of the plant under the influence of winds, and for the collection of same in convenient places, is favorably considered. The cost of construction of these booms for the purpose is placed at $1,000. In addition to these amounts an appropriation of $10,000 for each district is considered necessary for conducting operations. However, as before stated, that, as the eradication of the plant is not believed to be permanent, annual appropriations will be needed, for which provision can be made in the future, in the light of experience gained in the proposed operations outlined.

Respectfully submitted.

W. H. H. BENYAURD,
Lieut. Col. Corps of Engineers.
JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF ASSISTANT ENGINEER J. W. SACKETT.

TRANSPORT LAMPASAS, *At Sea, July 18, 1898.*

COLONEL: I have the honor to submit the following report on the investigation of the water hyacinth as an obstruction to navigation in the waters of Florida and Louisiana:

Attention is respectfully invited to my report upon the plant submitted to you September 9, 1896. In this report the character and extent of the plant and the great menace it is to navigation on the St. Johns River is described in detail. The conditions then existing prevail at the present time. The main channel of the river does not appear to be more obstructed than at that time, but the plant has extended into the smaller tributaries fully to the extent anticipated at that time. The plant seems now to be better able to thrive in lower portions of the river where the water is slightly brackish. The wharves at Jacksonville, within 25 miles of the mouth of the river, become at times badly obstructed with masses of the plant.

It was apprehended that the accumulation of these floating masses would be a serious menace to the health of the vicinity, but these fears do not seem to be well grounded, and it is now thought that the plant absorbs matter deleterious to health. The impression prevails that upon upper portions of the river, noted for malaria, where the plant has accumulated extensively, much less sickness of the malarial type prevails than formerly. In places in Louisiana where large masses of the plant have been piled upon the banks of canals and bayous and left there to dry up and decay, no bad effect upon the health of those living in the vicinity has been observed. It is therefore safe to assume that as an obstruction to navigation the plant need only be considered, and in adopting methods for destroying the plant or abating its growth sanitary conditions do not need to be considered.

On October 9, 1897, I made an investigation of Trout Creek, a small tributary of the St. Johns River, in St. John County, Fla., for the purpose of observing the conditions prevailing generally in such streams. Under the influence of the wind the masses of the plant drifting in the main channel of the river are driven to one bank or the other and are forced up the small streams, so that they become completely blocked. Were it not for the winds, the natural current of these small streams would carry most of the plants, which become loosened from the pack in which they grow, out into the main river, and much less labor would be required to keep them clear. These streams are cleared by breaking the packs apart and loosening them from the shore, when the current will generally carry them out. This work is required almost continually to enable rafts and small steamers to effect passage in and out.

On October 19, 1897, I procured a small light-draft stern-wheel steamer and proceeded up the St. Johns River for the purpose of making observations as to the conditions prevailing and to ascertain how far up the river the plant extended. At St. Francis I established an experiment station, which was left in charge of Mr. John E. Harris. The locality was particularly favorable for the purpose. The plants grew there in abundance, and a dead river near at hand gave an opportunity of studying them where they were undisturbed by passing steamers, and where there was very little current. Mr. Harris had previously made a study of the subject, and his observations are of considerable value. The experiments had in view crushing some of the plants between planing-mill rollers which were available, placing the crushed plants in the water to ascertain whether they would again grow, or whether plants would be produced from the fragments or not, and to try every suggested solution for spraying or treating the living plants to ascertain whether it was practicable to exterminate or stop their growth in that way. The result of these experiments is shown in the reports* of Mr. Harris, to which attention is invited. In brief, the crushing was entirely successful and the other methods were not.

I proceeded up the St. Johns River to a point about 2 miles above Orange Mound, about 25 miles above Lake Harney. Above the entrance to Lake Jessup the water hyacinth was scarce. Only a few scattered bunches were found in Lake Harney, and none at all were found above a point about 4 miles below Orange Mound, and this despite the fact that the cattlemen along that portion of the river had made every effort to introduce the plant there. Boat load after boat load had been taken up the river and scattered about, but the plants have either been carried out into the timber and over the adjacent prairie during high water and left there as the water receded, or have been carried downstream again with the current. On my way up the river there was no place in the channel where the hyacinths were so thick as to materially interfere with the progress of the boat, excepting one place opposite Lake Jessup. There we found it impracticable to follow the main channel of the river, and we went into Lake Jessup by the lower entrance and out again through the upper entrance, thus avoiding the pack.

The investigation confirmed the impression that the plant was not propagating or spreading so rapidly as the growth during the first few years after its introduction seemed to indicate it would. It seems to thrive vigorously during the fall after the late summer and the fall rains have set in. The winter frosts usually kill the tops and temporarily stop the growth of the plant. In the spring it begins to grow vigorously for a short time and then nearly stops growing during the low stage of water, and the leaves assume a yellowish tinge. During the first few years after its introduction this was not the case. It seemed to thrive most vigorously all the time and multiplied at a most alarming rate. The only thing which seemed to even temporarily interfere with its growth was a heavy frost. This seems to indicate the conditions prevailing were most favorable for its growth at first, but as the plant absorbed from the water the nutriment which it found in abundance the supply of nourishment became less in proportion to the demands made upon it, and it requires the fresh supply each year as it is brought into the river during flood stages. Reasoning from this, while the plant is a great nuisance and a serious menace to navigation, especially in the smaller streams, it is hardly likely to cause any more serious obstruction in the main river than has already been experienced.

On January 25, 1898, experiments were undertaken to ascertain whether any appreciable mass of the plants could be surrounded with a net and towed, the object being, in case the plants could be handled in this way, to tow them to the lower portion of the river, where the water was sufficiently salt to kill them. The net was made of three-sixteenth inch cotton line with a lead and cork line one-half inch in diameter.

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* Not received.

The net was 200 yards long. A tow boat with an engine of about 150 horsepower was used. It was found that by towing very slowly the plants which could be inclosed by the net could be moved about. It was necessary to have both wind and current favorable. When a heavy strain was put upon the net the plants began crowding over it, sinking the cork line, and the plants could no longer be retained. Various devices to remedy this were experimented with, and although better results could be obtained than at first, after two days' trial it was decided that that method would not answer the purpose desired.

I proceeded to New Orleans on February 16, 1898, and after investigating the conditions of the canals and bayous in that vicinity, I proceeded to Plaquemine, La., February 23. Mr. P. H. Thomson, assistant engineer, located at that place, rendered me valuable assistance, and I had an opportunity of observing the conditions of the growth of the plant in Bayou Plaquemine.

A considerable quantity of the plant was found growing in the soil of the bank of the bayou in moist places. These plants were uniformly small, and I have no doubt they grew from the seed deposited there during a high stage of the water.

Practically all the bayous of southern Louisiana are badly infested with the plant. The Vermilion is entirely blocked from the mouth up for a distance of 17 miles. Bayou Black, Blue Bayou, and Bayou Leopold are entirely closed. There are serious obstructions on Bayou Teche. Navigation is unsafe from Franklin to the mouth. On the canals in the vicinity of New Orleans constant work is required from April to August to keep them open for navigation. I am informed that during the summer sixteen men are constantly employed on the New Basin Canal in throwing the hyacinth from the canal. In this canal it is said that they have used a boom of logs, to which slats are nailed, for the purpose of towing the plants out, and it seems successfully. On Harveys Canal the plants are thrown out with pitchforks onto the banks and there left to dry. Great piles of them decay and dry up and leave an extraordinarily small amount of refuse.

The three States of Louisiana, Mississippi, and Florida are the only ones that appear to have the hyacinths to an extent that interferes with navigation. The St. Johns River in Florida, a few streams in southern Mississippi, and all the bayou system of Louisiana need immediate attention. It is recommended that two stern-wheel light-draft steamboats be built, fitted with an arrangement for gathering the plants and with two sets of heavy rollers, the first set corrugated for the purpose of crushing the plants and the second for more thoroughly pressing them—one for St. Johns River, Florida, and the other for the waters of Louisiana and Mississippi. These boats should be scow built, of 25 feet beam and 90 feet long. It is estimated that the cost would be $25,000 each. There should also be built four smaller boats—20 feet beam and 60 feet long, with stern paddle wheels and machinery arranged to gather the plants from the bow and deposit them over the side onto the bank—for use on the canals and narrow streams. Three of these will be required for Louisiana and one for Florida. The cost would be $17,000 each.

Automatic log booms have been used successfully in Louisiana to prevent the hyacinths from entering the small streams. These are arranged so that they open when the current or wind is downstream and close when the current or wind is upstream. In order that the wind may open or close them, thin boards are nailed to the booms, projecting high enough above the water for the wind to have effect upon them.

Mr. Thomson has discovered that "a saturated solution of salt with enough quicklime added to make a good spraying mixture" is very effective in killing the plant. He has found that the plant is killed, root and all, within forty-eight hours. He applied some of this mixture May 26, and up to June 9 no sign of new growth was evident.

It is recommended that an appropriation of $95,000 be made for the waters of Louisiana and adjacent States, wherever the plant may be found, and $60,000 for Florida; the former to provide for a crushing boat and three of the smaller boats, $12,000 for log booms, and $7,000 for spraying the plants; the latter appropriation of $60,000 to provide for a crushing boat and one of the smaller boats, $11,000 for log booms, and $7,000 for spraying the plants.

Very respectfully, your obedient servant,

J. W. SACKETT,
Assistant Engineer.

Lieut. Col. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

APPENDIX Q.

IMPROVEMENT OF RIVERS AND HARBORS ON THE WESTERN COAST OF FLORIDA, SOUTH OF AND INCLUDING SUWANEE RIVER.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, LIEUT. COL. W. H. H. BENYAURD AND CAPT. HENRY JERVEY, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. **Caloosahatchee River, Florida.**
2. **Charlotte Harbor and Pease Creek, Florida.**
3. **Sarasota Bay, Florida.**
4. **Manatee River, Florida.**
5. **Tampa Bay, Florida.**
6. **Hillsboro Bay, Florida.**
7. **Anclote River, Florida.**
8. **Withlacoochee River, Florida.**
9. **Suwanee River, Florida.**

SURVEY.

10. **Tampa Bay, Florida.**

HARBOR LINES.

11. **Hillsboro River at Tampa, Florida.**

UNITED STATES ENGINEER OFFICE,
Tampa, Fla., July 25, 1899.

GENERAL: I have the honor to submit herewith my annual reports * * * for the year ending June 30, 1899.

* * * * * * *

Very respectfully, your obedient servant,

HENRY JERVEY,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

Q 1.

IMPROVEMENT OF CALOOSAHATCHEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to Reports of the Chief of Engineers, 1896, Part II, pages 1327 and 1328, and 1898, Part II, page 1334.

No work was accomplished during the fiscal year ending June 30, 1899. It is proposed to expend the appropriation of March 3, 1899, for maintenance, in removing such snags and overhanging trees as have become obstructions during the cessation of work, in dredging the shoals where less than the required depth is found, and in reestablishing such channel marks as may be necessary.

An appropriation of $1,000 annually, or $2,000 biennially, will be required to keep the river in a fair navigable condition.

Caloosahatchee River is in the collection district of Key West, which is the nearest port of entry. The nearest light-house is Sanibel Light, and the nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1898, balance unexpended	$223.75
Amount appropriated by river and harbor act approved March 3, 1899	2,000.00
	2,223.75
June 30, 1899, amount expended during fiscal year	3.02
July 1, 1899, balance unexpended	2,220.73
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	1,000.00

Appropriations for improvement of Caloosahatchee River, Florida.

August 2, 1882	$5,000.00
July 5, 1884	5,000.00
August 5, 1886	4,000.00
August 11, 1888	10,000.00
September 19, 1890	3,600.00
July 13, 1892	1,000.00
August 18, 1894	2,000.00
June 3, 1896	1,000.00
March 3, 1899	2,000.00
Total appropriated	33,600.00
Expenditures to June 30, 1899	31,379.27
Balance unexpended June 30, 1899	2,220.73

COMMERCIAL STATISTICS.

None have been received since last annual report. Letters were addressed to business men of that region, but no replies had been received up to June 30, 1899.

Q 2.

IMPROVEMENT OF CHARLOTTE HARBOR AND PEASE CREEK, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to Reports of the Chief of Engineers, 1896, Part II, pages 1329 and 1330; 1897, Part II, pages 1559 and 1560; and 1898, Part II, pages 1335 and 1336.

No work was done during the fiscal year ending June 30, 1899. The result of the improvement is a channel with an available depth of 12 feet at mean low water, from a point opposite the railroad wharf at Punta Gorda to Boca Grande entrance, Gulf of Mexico. This channel is 200 feet wide for its entire length except in the cut near the wharves at Punta Gorda. The first section of this cut is 1,764 feet long and 120 feet wide. The next section is 4,729 feet long and 160 feet wide. There is a basin 300 feet square at the end of Long Dock. From this basin the channel continues upstream in a straight line for a distance of 5,620 feet, to a point opposite the terminal wharf of the Plant Railway System. The first 1,000 feet of this section of the dredged channel is 70 feet wide. Thence the channel has been dredged to a width of 35 feet for a length of 4,520 feet. And adjoining its upper end is a basin 100 feet square. The $25,000 appropriated by the river and harbor act of March 3, 1899, will be used for widening this section of the channel, under the project approved March 29, 1899. It having been decided to do the work by contract, proposals were solicited, the bids to be opened June 15, 1899. Two bids were received, as given in the "Abstract of proposals," etc., herewith, but at the end of the fiscal year no contract had been awarded. The annual cost of maintaining the channel, when completed under the present project, will be about $1,000.

A former project for the improvement of Pease Creek (Peace River) was adopted in 1881. The improvement was to provide a channel 30 feet wide, an available depth of 24 inches, for a distance of 100 miles from the river's mouth to Fort Meade, during one-half of the year. With appropriations amounting to $13,000, the river was cleared for a distance of 64 miles by the removal of snags and rocks, and the cutting down of overhanging trees. A survey was made and the river mapped in 1887. The appropriations were exhausted, and the river soon became filled with obstructions again. The Florida Southern road was completed to Punta Gorda about the time the river survey was finished, which entirely changed the commercial conditions and rendered a modification of the project advisable. Accordingly the present project was inaugurated under the river and harbor act appropriation of September 19, 1890.

Charlotte Harbor is in the collection district of Key West, and Punta Gorda is the nearest port of entry; nearest light-house is Gasparilla Light, and the nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1898, balance unexpended	$452.78
Amount appropriated by river and harbor act approved March 3, 1899	25,000.00
	25,452.78
June 30, 1899, amount expended during fiscal year	505.07
July 1, 1899, balance unexpended	24,947.71
July 1, 1899, outstanding liabilities	18.00
July 1, 1899, balance available	24,929.71
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriations for improvement of Charlotte Harbor and Pease Creek, Florida.

September 19, 1890	$35,000.00
August 18, 1894	20,000.00
June 3, 1896	20,000.00
March 3, 1899	25,000.00
Total appropriated	100,000.00
Expenditures to June 30, 1899	75,052.29
Balance unexpended June 30, 1899	24,947.71

Abstract of proposals for dredging 125,000 cubic yards, more or less, in Charlotte Harbor, Florida, received by Capt. Henry Jervey, Corps of Engineers, in response to advertisement dated May 15, 1899, and opened at 11 a. m., June 15, 1899.

No.	Name and address of bidder.	Price per cubic yard.	Amount.	Remarks.
1	Stewart Contracting Co., Columbia, S. C.	$0.19	$23,750	Plant at Punta Gorda and Key West, Fla.
2	National Dredging Co., Wilmington, Del.	.19	23,750	Plant at Mobile, Ala.

The amount to be expended under this advertisement is $20,000.

COMMERCIAL STATISTICS.

Commerce of Charlotte Harbor and Pease Creek, Florida, during the year ending December 31, 1898.

Name of article.	Gross tonnage.	Estimated value.
Fertilizers and pebble Phosphate	69,378	$708,780
Cattle	225	11,250
Grain	3,500	38,104
Hides	10	2,250
Honey, syrup, etc	6	371
Lumber	1,250	15,000
Merchandise	2,400	120,990
Hay	1,000	18,875
Vegetables	1,700	510,000
Fish and oysters	25,758	146,895
Oranges	887	32,000
Pineapples, etc	232	9,315
Total	106,346	1,613,830

Arrivals and departures of vessels for the year ending December 31, 1898.

Class of vessels.	Arrivals.	Tons.	Departures.	Tons.
Steamships	13	14,567	13	14,567
Steamboats, light draft	352	138,885	352	138,885
Sailing vessels	34	27,715	34	27,715
Yachts	15	412	15	412
Total	414	181,579	414	181,579

Estimated number of passengers carried by the above vessels during the year ending December 31, 1898	9,618
Estimated percentage of total trade of neighborhood carried by water	80
Probable increase in per cent of trade if the improvement were completed.	150 to 175

Q 3.

IMPROVEMENT OF SARASOTA BAY, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to the Report of the Chief of Engineers for 1896, Part II, pages 1331 and 1332.

The act of Congress of June 3, 1896, appropriated $2,500 for improving Sarasota Bay from Tampa Bay to Caseys Pass, while the previous appropriations were applicable only as far as the town of Sarasota. The survey of 1889 was made, as directed, "From Tampa Bay to Caseys Pass," and an estimate was presented amounting to $37,500 for securing a channel 75 feet wide and 3 feet deep at mean low water through the shoals south of Sarasota. Under the act of 1896 the latter project is included, so that the total estimate of cost is now $55,000.

No work was done during the fiscal year ending June 30, 1899.

There is a cut through the shoals near Palma Sola Point, which is 2,292 feet long, 50 feet wide, and with an available depth of 5 feet at mean low water. A cut through long bar is 4,500 feet long, and is of the same width and depth as the cut off Palma Sola Point. From the 3-foot contour in the southern end of Sarasota Bay a cut extends into "The Mangroves" for a distance of 1,460 feet. Its width is 50 feet, and its available depth 3 feet at mean low water. This last channel can be of no service until extended 1,573 feet further. The sum of $5,000, appropriated by the river and harbor act of March 3, 1899, for "Improving Sarasota Bay, Florida: Continuing improvement, five thousand dollars," will be expended in dredging at the shoals between the town of Sarasota and Caseys Pass, as approved by the Chief of Engineers on March 28, 1899.

In addition to the last appropriation the amount required to complete the project is $37,500. The annual cost of maintaining the cuts already will be about $1,000. That of maintaining the complete cuts will be about $2,500. The value to commerce of this improvement as far as the town of Sarasota will be commensurate with its cost. The region between the town and Caseys Pass is sparsely settled and its commerce small, which would cause that part of the improvement to be less valuable; but the country is well adapted to the raising of fruit and vegetables, and no doubt immigration will set in as soon as water transportation can be secured.

Sarasota is in the collection district of Tampa, which is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fortifications are in Tampa Bay, Florida.

Money statement.

July 1, 1898, balance unexpended	$571.54
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	5,571.54
June 30, 1899, amount expended during fiscal year	61.37
July 1, 1899, balance unexpended	5,510.17
Amount (estimated) required for completion of existing project	37,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	37,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Sarasota Bay, Florida.

September 19, 1890	$5,000.00
July 13, 1892	2,500.00
August 18, 1894	2,500.00
June 3, 1896	2,500.00
March 3, 1899	5,000.00
Total appropriated	17,500.00
Expended to June 30, 1899	11,989.83
Balance unexpended June 30, 1899	5,510.17

COMMERCIAL STATISTICS.

None have been received since last Annual Report. Letters were addressed to business men of that region, but no replies had been received up to June 30, 1899.

Q 4.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1332 and 1333, Report of the Chief of Engineers for 1896.

The act of Congress of June 3, 1896, which appropriated $4,000 for continuing the improvement, provided "that $3,000, or as much thereof as may be necessary, be used in dredging, deepening, and otherwise improving the navigation of the channel known as the Cut-off, extending from said Manatee River, on the north side thereof, and below the town of Palmetto, into Terraceia Bay." For a description of this locality, the requirements of commerce, and the project adopted, attention is invited to pages 1562 and 1563, Report of the Chief of Engineers for 1897.

The project for the improvement of the Cut-off was submitted on June 17, 1897, and approved June 23, 1897.

The last work done in this locality was from August to October, 1897, and during that period a channel was made from the Manatee River through the Cut-off to Terraceia Bay, 2,840 feet long, 50 feet wide, and 4.5 feet deep at mean low water, requiring the removal of 20,074 cubic yards of material. A temporary training wall 1,475 feet long was built on one side of this cut. Three channel marks were built in the Manatee River and two in Terraceia Bay.

This improvement has resulted in forming a channel which can be used by small light-draft boats. It is not wide enough for some of the steamers that ply regularly between Tampa and the Manatee River. As the bulk of the traffic in and out of Terraceia Bay and the Manatee River is carried by the steamers, the advantage of the channel between the two bodies of water is apparent. It is desirable that this channel should be completed as contemplated, and that the balance required, $9,000, be made available.

The river and harbor act approved March 3, 1899, appropriated $10,000 for continuing the improvement of the Manatee River: "*Provided*, That eight thousand dollars, or so much thereof as may be necessary, be used in dredging, deepening, and otherwise improving the navigation of the channel known as the Cut-off * * *"

The project for the expenditure of available funds was submitted

March 10, 1899, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, and approved March 24, 1899.

The charge of this work was transferred April 1, 1899, and placed under the jurisdiction of a new district office established at Tampa, Fla., on that date.

No work has been done in this locality during the past fiscal year. The U. S. dredge *Suwanee*, with which it is proposed to continue dredging under the new appropriation, is at work on the east coast of Florida and has not yet been transferred to this district.

The depth of water called for by the project has been obtained, except across the bar at the mouth of the river. To do this work in an economical manner the full amount of the balance of the estimate for completing the project, $27,000, should be made available before it is commenced.

During the past few years the value of property and the amount of commerce in this vicinity has greatly increased, owing to the fact that the severe cold of 1895 caused such slight injury to fruits and vegetables as compared with the damage resulting generally elsewhere throughout the State. It is now said to have become the largest shipping point for these products on the west coast of Florida.

As stated in the last Annual Report, the combined dredge and snag boat *Suwanee* has become old, and it will soon become necessary to replace it by another. Where only small appropriations are made available for each river, and the localities at which work can be done to advantage are widely separated, it has been proved that more good can be accomplished by such a plant operated by hired labor than by any other method.

Manatee is in the collection district of Tampa. Tampa is the nearest port of entry. Nearest light-house is Egmont Key Light. The nearest fortifications are in Tampa Bay, Florida.

Money statement.

July 1, 1898, balance unexpended	$149.90
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	10,149.90
June 30, 1899, amount expended during fiscal year	48.39
July 1, 1899, balance unexpended	10,101.51
Amount (estimated) required for completion of existing project	27,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	27,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Manatee River, Florida.

August 2, 1882	$12,000.00
August 5, 1886	11,000.00
August 11, 1888	5,000.00
September 19, 1890	6,000.00
July 13, 1892	6,000.00
August 18, 1894	3,000.00
June 3, 1896	[1] 4,000.00
March 3, 1899	[2] 10,000.00
Total	57,000.00
Expenditures to June 30, 1899	46,898.49
Balance unexpended June 30, 1899	10,101.51

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[1] Includes $3,000 for Terraceia Cut-off.

[2] Includes $8,000 for Terraceia Cut-off.

COMMERCIAL STATISTICS.

Commerce of Manatee River, Florida, for year ending December 31, 1898.

[Compiled from information furnished by Mr. W. R. Fuller, Tampa, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Fertilizers	1,500	Vegetables	7,000
Grain	50	Oranges	4,000
Hides	10	Tobacco	150
Lumber	600		
Merchandise	10,000	Total	24,310
Hay	1,000		

Steamers	4
Sail vessels	25
Tonnage	1,500
Estimated number of passengers	12,000
Estimated percentage of total trade carried by water	100
Probable per cent of increase if improvements were completed	50

Q 5.

IMPROVEMENT OF TAMPA BAY, FLORIDA.

Tampa Bay is a large land-locked body of water on the west coast of Florida with an average width of from 6 to 7 miles, and a length, inclusive of its two tributary bays, of about 25 miles in a general northeast and southwest direction. It is the approach to the city of Tampa and Port Tampa, the latter being a railroad terminus and one of the important shipping points for phosphate and produce from this section of Florida. A draft of 22 feet can be taken in over the bar at high water, but the deepest draft to which vessels have been loaded at Port Tampa is 21½ feet and this only on unusual spring tides.

The entrance to the bay is marked by Egmont Key Light-House, and has shoals extending about 5 miles from shore. Between these shoals there are two main channels—the north channel with a depth of 20 feet and the southwest channel with a depth of 16 feet. Egmont Key lies fair in the entrance and the shoals making off to the westward from it separate the two channels.

Old Tampa Bay enters the northwestern end of Tampa Bay from the northwestward; it is about 15 miles long with an average width of 6 miles. Its narrowest part is where it joins Tampa Bay, where its width is a little less than 2½ miles. This bay is generally shallow, but at the southern end has several deep channels; one of these leads along the eastern shore of the bay at a distance of about three-fourths of a mile from the beach and forms the approach to and harbor of Port Tampa. Between deep water in Tampa Bay and the deep channel in Old Tampa Bay are two bars through which channels were made in 1889–1892 by dredging.

An examination of Tampa Bay from Egmont Key to the wharves at Tampa, with a view to its improvement, was made in 1879. A report thereon, dated August 25, 1879, with a plan of improvement, is printed as Appendix J 18 to the Report of the Chief of Engineers for 1879.

Under this plan and prior to 1888 operations were confined to dredging a 9-foot channel from the city of Tampa to the bay.

In 1888 this project was modified and a provision included for forming a channel 200 feet wide and 20 feet deep at mean low water from the Gulf to Port Tampa. From 1880 to 1892 Congress appropriated for the improvement of Tampa Bay $130,000, being all the funds required by the original and modified projects. Of this amount $80,000 was expended on the channel from Tampa through Hillsboro River and Bay and the balance in dredging the bars at the mouth of Old Tampa Bay to form a channel to Port Tampa.

The Port Tampa channel was completed May 12, 1892. Up to that time about 115,000 cubic yards of material had been removed from the two bars and the channel contemplated by the project, 200 feet wide and 20 feet deep at mean low water, completed.

In 1897 a survey of Tampa Bay was made in compliance with the river and harbor act of June 3, 1896. A report of this survey, with a plan and estimate for a 24-foot channel from the Gulf to Port Tampa, is printed in the Report of the Chief of Engineers, 1897, page 1596 et seq., and in House Doc. No. 88, Fifty-fifth Congress, first session.

Under the provisions of public resolution No. 40, approved June 13, 1898, a plan and estimate for a 30-foot channel from the Gulf to Port Tampa was submitted November 14, 1898, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, the total estimated cost being $3,335,000. This report is printed in House Doc. No. 52, Fifty-fifth Congress, third session.

PRESENT PROJECT AND OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

The river and harbor act approved March 3, 1899, contained the following provisions:

> Improving Tampa Bay, Florida: For improvement of Tampa Bay, Florida, from its entrance into the Gulf of Mexico to Port Tampa, seventy-five thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary towards securing a channel depth of twenty-seven feet from said Gulf of Mexico to Port Tampa, and of a width five hundred feet across the bar and three hundred feet in the bay, as proposed in the report of November fourteenth, eighteen hundred and ninety-eight, published in House Document number fifty-two, Fifty-fifth Congress, third session, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate six hundred and seventy-five thousand dollars, exclusive of the amount herein appropriated.

As the cost of the 27-foot channel provided by the above act had never been estimated, a new project and estimate was submitted on March 27, 1899, by the district officer as follows:

Dredging in the bay, 3,700,000 cubic yards, at 15 cents	$555,000
Dredging on the bar, 450,000 cubic yards, at 30 cents	135,000
Engineering and contingencies	60,000
Total	750,000

This project was approved April 10, 1899, by the Secretary of War, and contemplates dredging first to 24 feet and afterwards increasing the depth to 27 feet.

The charge of this work was transferred April 1, 1899, to a new district office established at Tampa, Fla., on that date.

The work was advertised May 26, 1899, and bids opened June 29, 1899. The lowest bidder is the Alabama Dredging and Jetty Company, of Mobile, Ala., the prices bid being 15 cents per cubic yard for work on the bar and 11.99 cents per cubic yard for work in the bay.

PROPOSED APPLICATION OF FUNDS ON HAND AND THOSE ASKED FOR FOR FISCAL YEAR ENDING JUNE 30, 1901.

It is proposed to enter into contract under the bids opened June 29, 1899, in accordance with the specifications and advertisement dated May 26, 1899, and to expend the funds available in dredging the most shoal section of the channel at the "Narrows" to a depth of 24 feet, and to complete this part of the work by June 30, 1900.

Tampa Bay and Port Tampa are in the collection district of Tampa, Fla. Tampa is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fortifications are in Tampa Bay.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$75,000.00
June 30, 1899, amount expended during fiscal year	737.19
July 1, 1899, balance unexpended	74,262.81
July 1, 1899, outstanding liabilities	29.04
July 1, 1899, balance available	74,233.77
Amount (estimated) required for completion of existing project	625,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	150,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations under previous projects.

By act of—	
June 14, 1880	$10,000
March 3, 1881	10,000
August 2, 1882	20,000
July 5, 1884	20,000
August 5, 1886	10,000
August 11, 1888	25,000
September 19, 1890	25,000
July 13, 1892	10,000
Total appropriated for previous projects	130,000
Expended:	
On channel from Tampa through Hillsboro River and Bay	80,000
In dredging bars at entrance of old Tampa Bay	50,000
Expended on previous projects	130,000

Under present project.

By act of—	
March 3, 1899	$75,000

Abstract of proposals for dredging in Tampa Bay, Florida, received in response to advertisement of May 26, 1899, and opened at 11 a. m., June 29, 1899, by Capt. Henry Jervey, Corps of Engineers.

No.	Name and address of bidder.	Dredging on the bar, 450,000 cubic yards.		Dredging in the bay, 3,700,000 cubic yards.		Total amount of bid.
		Price.	Amount.	Price.	Amount.	
1	National Dredging Co., Wilmington, Del	$0.27	$121,500	$0.19	$703,000	$824,500
2	Stewart Contracting Co., Columbia, S. C	.163	73,350	.133	492,100	565,450
a3	Alabama Dredging and Jetty Co., Mobile, Ala.	.15	67,500	.1199	443,630	511,130
4	Alantic, Gulf, and Pacific Co., New York, N. Y.	.248	111,600	.158	584,600	696,200
5	International Contracting Co., Syracuse, N. Y.	.20	90,000	.15	555,000	645,000
6	Fredrick W. Dashe, Arlington, N. J.	.1725	77,625	.1725	638,250	715,878

a Recommended for acceptance.

No. 1. Date of beginning work and rate of board for United States inspector not filled in.

No. 2. Date of beginning work, September 20, 1899. Definite description and location of plant not given. Bid signed by A. R. Stewart, general manager; no evidence filed of authority to sign. Prices not in figures.

No. 3. Evidence of authority of Fred E. Jones to sign for company attached to but one copy of bid.

No. 4. Date of beginning work set November 15, 1899. Nature of work to be done not filled in guarantee. No seal to signature. Authority to sign attached to one copy of bid. Prices not written in words.

No. 6. Bidder modifies paragraph 36. No seal. Date of beginning work September 30, 1899. Description of plant not given.

The amount to be expended under this advertisement is $750,000.

COMMERCIAL STATISTICS.

Commerce of Tampa Bay, Florida, for the year ending December 31, 1899.

[Compiled from information furnished by the Plant Steamship Line, the custom-house officials, and the Tampa Board of Trade.]

Articles.	Quantity.	Gross tonnage.
Phosphate ....tons..	169,916	169,916
Tobacco		424
Oranges		3,000
Vegetables		3,500
Merchandise		27,000
Coal		16,316
Cattle		16,000
Total		236,156

Steam vessels	306
Sailing vessels	134
Total	440
Tonnage	249,058

Q 6.

IMPROVEMENT OF HILLSBORO BAY, FLORIDA.

Hillsboro Bay enters the northeastern end of Tampa Bay from the northward. It is about 10 miles long in a general north and south direction, and has an average width of about 4½ miles. An available channel depth of 20 feet exists through Tampa Bay. At the confluence of Hillsboro Bay with Tampa Bay the channel is obstructed by shoals having from 10 to 11 feet over them. A practicable channel exists through these shoals having a least depth of 12½ feet at mean low water.

Hillsboro River, emptying into the northwestern end of Hillsboro Bay, is a narrow stream, at the mouth of which is the city of Tampa. The 12-foot contour in the bay approaches the mouth of the river at Tampa to within a distance of 3 miles, measured on a straight line.

A survey of this locality with a view to its improvement was made in 1879. The report of this survey is printed in the Report of the Chief of Engineers for 1879, pages 870 to 873. At that time there existed through the broad flat between Tampa and deep water in the bay a narrow channel, with an average available depth of about 5 feet, formed by the waters of the Hillsboro River. A ledge of rock extending across the mouth of the river had only 7 feet of water over it.

The original project, adopted in 1879, had for its object the formation of a 9-foot channel from the 9-foot curve in the bay to wharves at Tampa in Hillsboro River 150 feet wide in the bay and 200 feet wide in the river, at an estimated cost of $97,000. Nearly $70,000 was expended under this project. In 1888 this project was modified to provide for the formation and maintenance of a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 20 feet deep and 200 feet wide from the outer bar to Port Tampa.

Between 1880 and 1892 Congress appropriated $130,000 for the improvement of Tampa Bay, being all the funds required for the original and modified projects. Of this amount, $80,000 was expended on the channel in Hillsboro Bay and Hillsboro River.

Work in Hillsboro Bay channel was stopped June 3, 1893, at which time the channel was 200 feet wide in the mouth of the Hillsboro River, with a depth of 9 feet, and from 75 to 100 wide in the bay, with an available depth of not more than 7 feet. There have been no dredging operations since that date.

On June 3, 1898, a plan and estimate were submitted for the improvement of Hillsboro Bay, Florida, from its confluence with Tampa Bay through Hillsboro Bay and river to the city of Tampa. The report of this contemplated improvement is printed in the Annual Report of the Chief of Engineers, for 1898, page 1357.

PRESENT PROJECT AND OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

There have been no active operations during the year. The work was transferred April 1, 1899, to the new district established on that day with headquarters at Tampa, Fla.

The river and harbor act of March 3, 1899, appropriated $125,000 for "Improving Hillsboro Bay, Florida, in accordance with the project printed in House Doc. No. 545, Fifty-fifth Congress, second session." The project referred to contemplates a channel in Hillsboro River from a point about 100 feet south of the bridge crossing the river at Lafayette street to the mouth of the river, and from there along the line of the shortest distance to the 12-foot contour in Hillsboro Bay. This channel to be 12 feet deep at mean low water, 200 feet wide in the river, and 150 feet wide in the bay. The work proposed is estimated to cost $300,000, with $1,000 annually for maintenance. A survey of of the mouth of Hillsboro River was made in June, 1899, to determine the amount of rock requiring removal under the project inaugurated by the river and harbor act of March 3, 1899. About 16,000 cubic yards of rock will have to be excavated.

Proposals for dredging a channel about 65 feet wide in the bay and 85 feet wide in the river, with a depth of 12 feet at mean low water, have been asked under advertisement dated June 29, 1899, to be opened July 31, 1899.

CONDITION OF THE WORK JUNE 30, 1899.

The available depth by the present channel into Tampa is 7 feet at mean low water. The channel is narrow and tortuous, and can be navigated only by very light draft craft with the aid of numerous channel marks, which are difficult to maintain. It is an almost daily occurrence for vessels entering or leaving the river to run aground.

A draft of 5 feet can be carried in Hillsboro River above the first bridge for a distance of 8 miles to the head of navigation.

PROPOSED APPLICATION OF FUNDS ON HAND AND THOSE ASKED FOR FOR THE FISCAL YEAR ENDING JUNE, 1901.

It is proposed to enter into contract for dredging a channel in the river and bay to the full authorized depth of 12 feet and of as great a width as permitted by the available funds. It is estimated that about 3,000 cubic yards of rock and about 360,000 cubic yards of soft material can be removed during the next fiscal year, and a channel formed 85 feet wide in the river and 65 feet wide in the bay.

Hillsboro Bay is in the collection district of Tampa, Fla. Tampa is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fortifications are in Tampa Bay.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$125,000.00
June 30, 1899, amount expended during fiscal year	652.39
July 1, 1899, balance unexpended	124,347.61
July 1, 1899, outstanding liabilities	37.00
July 1, 1899, balance available	124,310.61
Amount (estimated) required for completion of existing project	175,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	175,000.00

Submitted in compliance with requirements of sections 2 of river and bor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

A list of appropriations made for previous projects in this locality are given in the report for the improvement of Tampa Bay in the Annual Report of the Chief of Engineers for 1899, page 1634.

Under present project, by act of March 3, 1899	$125,000.00
Total expended	652.39
Balance unexpended June 30, 1899	124,347.61

COMMERCIAL STATISTICS.

Commerce for Hillsboro Bay for year ending December 31, 1898.

[Compiled from information furnished by the Tampa Board of Trade.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Merchandise	24,770	Oranges	4,000
Fertilizers	1,500	Tobacco	150
Grain	50		
Lumber	600	Total	32,070
Hay	1,000		

Steam and sail vessels (all sizes)	1,304
Tonnage	101,491
Number of passengers	12,000
Estimated percentage of total trade carried on by water	

Q 7.

IMPROVEMENT OF ANCLOTE RIVER, FLORIDA.

For the preliminary examination of this river, its survey, the requirements of commerce, the project adopted, and its estimated cost, attention is invited to Reports of the Chief of Engineers, 1895, Part II, pages 1573-1576, and 1898, Part II, pages 1361-1363.

The appropriation for improving Anclote River, Florida, in accordance with the project submitted, $5,000, river and harbor act of March 3, 1899, will be used to begin the adopted project. The amount will be expended in dredging that portion of the channel between Sponge Harbor and the entrance to Tarpon Bayou as soon as a Government dredge is available for the work.

There were no operations during the fiscal year ending June 30, 1899.

It is estimated that the sum of $46,500, required to complete the work, can be profitably expended in carrying out the project during the fiscal year ending June 30, 1901.

Anclote River is in the collection district of St. Marks. Tampa is the nearest port of entry. The nearest fortifications are at Egmont Key. Nearest light-house is Anclote Keys Light.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$5,000.00
July 1, 1899, balance unexpended...	5,000.00
Amount (estimated) required for completion of existing project...	46,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	46,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Anclote River, Florida.

March 3, 1899...	$5,000

COMMERCIAL STATISTICS.

None available for the year ending December 31, 1898. The commerce is believed to be growing on account of an active sponge market.

Q 8.

IMPROVEMENT OF WITHLACOOCHEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to Report of the Chief of Engineers, 1898, pages 1340-1341 and 1363-1369.

The adopted project for the improvement of this river was practically completed on November 14, 1892. No work was done during the fiscal year ending June 30, 1899, and none is contemplated during the next fiscal year.

The improvement has not resulted in any marked benefit to commerce, as the season when the river is open and that when it is necessary to ship the products of the region do not correspond. Large deposits of phosphate have been discovered since the project was formed. The only means of getting this product to the coast is turnished by the railroads, and the cost of this transportation amounts to about one-half the value of the phosphate on board ship.

Withlacoochee River is in the collection district of St. Marks. Cedar Keys is the nearest port of entry. Nearest fortifications are at Egmont Key. Nearest lighthouse is Cedar Keys Light.

Money statement.

July 1, 1898, balance unexpended	$785.12
July 1, 1899, balance unexpended	785.12
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	1,000.00

Appropriations for the improvement of Withlacoochee River, Florida.

March 3, 1881	$7,500	September 19, 1890	$5,400
July 5, 1884	3,000	August 18, 1894	800
August 5, 1886	3,000		
August 11, 1888	5,000	Total	24,700

COMMERCIAL STATISTICS.

No statistics of the commerce of the Withlacoochee River, Florida, for the year ending December 31, 1898, are available.

Q 9.

IMPROVEMENT OF SUWANEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained attention is invited to Reports of the Chief of Engineers, 1896, pages 1335–1336, and 1898, pages 1341–1342.

There was no work done during the fiscal year ending June 30, 1899.

The sum of $5,000, appropriated by the river and harbor act of March 3, 1899, will be expended, in accordance with the project approved March 29, 1899, for the removal of such shoals as may have formed in the dredged channel at the mouth of the river and at Derricks Gap, in reestablishing such channel marks as may be needed, and the remainder of the appropriation to be expended in work upon the rock shoals above Branford. It is estimated that the sum of $10,158, required to complete the work, can be profitably expended in carrrying out the project during the fiscal year ending June 30, 1901.

Suwanee River is in the collection district of St. Marks. Cedar Keys is the nearest port of entry. Nearest fortifications are at Egmont Key. Nearest light-house is Cedar Keys Light.

Money statement.

July 1, 1898, balance unexpended	$84.14
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	5,084.14
June 30, 1899, amount expended during fiscal year	9.19
July 1, 1899, balance unexpended	5,074.95

Amount (estimated) required for completion of existing project	$10,158.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,158.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Suwanee River, Florida.

June 14, 1880	$5,000.00
March 3, 1881	3,000.00
August 2, 1882	5,000.00
July 5, 1884	5,000.00
August 5, 1886	5,000.00
August 11, 1888	15,000.00
September 19, 1890	3,000.00
July 13, 1892	3,000.00
August 18, 1894	3,000.00
June 3, 1896	3,000.00
March 3, 1899	5,000.00
Total	55,000.00
Expenditures to June 30, 1899	49,925.05
Balance unexpended June 30, 1899	5,074.95

COMMERCIAL STATISTICS.

No statistics for the commerce of the Suwanee River, Florida, for the year ending December 31, 1898, are available. Inquiries by letter were made, but no replies had been received up to June 30, 1899.

Q 10.

PLAN AND ESTIMATE FOR IMPROVEMENT OF TAMPA BAY, FLORIDA, FROM PORT TAMPA TO THE MOUTH OF THE BAY, IN GULF OF MEXICO.

[Printed in House Doc. No. 52, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, December 1, 1898.

SIR: I have the honor to submit the accompanying report of November 14, 1898, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, containing plan and estimate for improvement of Tampa Bay, Florida, from Port Tampa to the mouth of the bay, in the Gulf of Mexico, so as to give a depth of water 30 feet deep at mean low water, 500 feet wide on the bar at the entrance of Tampa Bay and 300 feet wide in the bay itself, called for by joint resolution of Congress approved June 4, 1898.

Colonel Benyaurd states that to make the improvement contemplated would require dredging through a total length of 26.9 miles of shoals, including 3.2 miles across the bar; that in his opinion a channel of the contemplated depth of 30 feet over the bar could not be permanently maintained without the constant services of dredges, and that there will be places in the bay that will require dredging from time to time to maintain channel depths.

A channel of the dimensions stated would require the removal of 13,900,000 cubic yards of material, which, if done under the continuous-contract system, it is estimated would cost, including contingencies, $3,335,000.

Colonel Benyaurd does not believe that the commerce of Port Tampa now, or in the near future, will demand a class of ships that would require such a depth of water as is contemplated by the resolution; and while he considers that, by reason of the commercial interests involved, it might be advisable to obtain a depth of 24 feet at mean low water (plan and estimate of cost of which will be found in House Doc. No. 88, Fifty-fifth Congress, first session, and in the Annual Report of the Chief of Engineers for 1897, p. 1596), he is of the opinion that it is not advisable, considering the enormous cost of the undertaking, to provide a channel depth of 30 feet at mean low water through Tampa Bay to the Gulf of Mexico.

I concur in his views.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., November 14, 1898.

GENERAL: In accordance with instructions contained in your letter of June 13, 1898, transmitting public resolution No. 40, approved June 4, 1898, in regard to presenting plans and estimates for the improvement of Tampa Bay, Florida, from Port Tampa to its mouth, in the Gulf of Mexico, I have the honor to present the following report:

The joint resolution referred to is as follows:

> *Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of War be, and he is hereby, authorized and directed to submit plans and estimates for the improvement of Tampa Bay, from Port Tampa to the mouth of the bay, in the Gulf of Mexico, so as to give a depth of water thirty feet deep at mean low water, five hundred feet wide on the bar at the entrance of Tampa Bay, and three hundred feet wide in the bay itself; and that the Secretary of War be, and is hereby, requested to inform Congress of his views as to the advisability of the proposed improvement.

The river and harbor act of June 3, 1896, provided for a survey of Tampa Bay, Florida, so as to obtain a channel depth of 24 feet from Port Tampa to the Gulf of Mexico. This survey was made and the report thereon will be found in the Report of the Chief of Engineers, United States Army, for 1897, pages 1596 et seq. The estimated cost of said improvement was $336,000.

The maps accompanying said report (five in number) were printed in House Doc. No. 88, Fifty-fifth Congress, first session. They were not reproduced in the Annual Report of 1897.

The results of that survey, the maps that accompanied the report, and other information on hand are amply sufficient to render the report as called for by public resolution No. 40 without recourse to another survey, which, if made, would cover the same identical ground.

Previous to making the above-mentioned survey a preliminary report as to the advisability of the improvement to a depth of 24 feet was made by Maj. Thomas H. Handbury, Corps of Engineers, printed in the Report of the Chief of Engineers, United States Army, for 1895, pages 1570 et seq.

In that report it was stated that the commerce of Tampa Bay had assumed considerable proportions; that an increase of channel depth to 24 feet from the entrance to Port Tampa would be of very great advantage to the commercial interests involved, and that it appeared from the information then available that the improvement desired could be effected and maintained at a reasonable expense. The results of the survey made in conformity therewith, viz, to obtain a channel depth of 24 feet, appeared to bear out the opinion expressed, that the improvement to that depth was eminently worthy of being undertaken.

It will here be stated that whenever the channel depth in any of the reports is mentioned, it is understood that reference is made to depth at mean low water.

To make the improvement contemplated in public resolution No. 40 would require dredging through a total length of 26.9 miles of shoals, including 3.2 miles across the bar. It is not considered that a channel of the contemplated depth of 30 feet over the bar could be permanently maintained without the constant services of dredges. It is also believed that there will be places in the bay that will likewise require dredging from time to time to maintain channel depths.

From investigations formerly made and stated in the report of 1897 it would appear that the bottom is not subject to any great disturbance due to wave action, and therefore a dredged channel through the bar may be expected to remain reasonably permanent without the aid of jetties. In the bay proper past experience has shown that training walls are not required to maintain a dredged channel.

To dredge a channel over a width of 500 feet across the bar and 300 feet in the bay to a depth of 30 feet at mean low water would require the removal of the following quantities of material:

	Cubic yards.
Across the bar	2,400,000
In bay to Port Tampa	11,500,000
Total	13,900,000

In the above estimate of quantities allowance has been made for back fill and ample side slopes.

To remove the above enormous quantities of material a very large plant would be required to complete the work in any reasonable number of years. As it is not expected that the Government would undertake to provide such a plant, it is considered, therefore, that such must be done by private parties.

With the continuous-contract system it is estimated that the dredging on the bar will cost about 25 cents per cubic yard and in the bay about 20 cents per cubic yard. Under these figures and the quantities above stated, the total cost would be—

Across the bar	$600,000
In the bay	2,300,000
Engineering and contingencies, 15 per cent	435,000
Total	3,335,000

If the work should be undertaken under ordinary contracts and with limited amounts appropriated the cost would be greatly increased, and I should not consider that the work could be done under an average cost of 30 cents per cubic yard.

As regards the draft of ships that navigate Tampa Bay, it is stated that many phosphate ships are loaded to a draft of 21 feet. There appears to be no difficulty in these ships navigating the inner bay or crossing the bar at high water.

The mean range of the tide varies from 1.54 feet at Egmont Key, at the entrance, to 1.95 feet at Port Tampa. Considering, then, an improved channel depth of 30 feet at mean low water, there would be a mean high-water depth at Egmont of 31.54 feet and at same stage of tide at Port Tampa 31.95 feet.

It is not believed that the commerce of Port Tampa now or in the near future will demand a class of ships that would require such a depth of water, and while I have considered that, by reason of the commercial interests involved, it might be advisable to obtain a depth of 24 feet at mean low water, I am of the opinion that it is not advisable, considering also the enormous cost of the undertaking, to provide a channel depth of 30 feet at mean low water through Tampa Bay to the Gulf of Mexico.

Very respectfully, your obedient servant,

W. H. H. Benyaurd,
Lieut. Col., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

Q 11.

ESTABLISHMENT OF HARBOR LINES IN HILLSBORO RIVER AT TAMPA, FLORIDA.

Office of Board of Public Works,
Tampa, Fla., August 12, 1899.

Dear Sir: I am instructed by the board of public works to respectfully ask that you establish the dock lines of the Hillsboro River at your earliest convenience, and by so doing greatly oblige.

Very truly, yours, etc.,

S. L. Biglow,
Clerk Board Public Works.

Capt. Henry Jervey.

[First indorsement.]

U. S. Engineer Office,
Tampa, Fla., August 16, 1899.

Respectfully submitted to the Chief of Engineers, United States Army, with recommendation that the dock lines in Hillsboro River at Tampa, Fla., be established under the provisions of section 11, river and harbor act approved March 3, 1899.

The approved project for the improvement of Hillsboro Bay, Florida, includes the formation of a channel in Hillsboro River below Lafayette Street Bridge, 12 feet deep at mean low water and 200 feet wide, narrowing to 150 feet at the mouth and thence into Hillsboro Bay. It is believed that the preservation of this harbor for the future needs of commerce requires that parallel dock lines should be established not less than 300 feet apart in the clear. This can be done at the present time with almost no interference with or injury to structures owned by private parties. The existing docks are confined to the east side of the river with the exception of a single dock and building on the west side immediately adjacent to and below Lafayette Street Bridge and a wood dock that lies well out in the river and close to the present navigable channel, placed there for convenience of loading or receiving wood. This wood dock encroaches on the proposed new channel and must soon become an obstruction to navigation. The other dock on the west side of the river would probably not become a serious obstruction during its lifetime unless the river should be improved above the bridge.

Tracings[1] in triplicate showing the dock lines proposed are submitted herewith in separate package. A description of the dock lines by courses, using true bearings, is inclosed in triplicate. Said description is so drawn that the proposed lines may be located from reference marks established by the board of public works of the city of Tampa or from permanent marks established by and recorded in this office in connection with the survey of Hillsboro River.

The dock line on the east side of the river is located with due regard to the position of existing docks and street lines to securing as long stretches of straight dock front as practicable, and to reducing the amount of rock excavation required under the approved project for a 12-foot channel. The only dock on the east side of the river that must be drawn back is at the extreme end of the Florida Central and Peninsular Railroad Company's track, which has been pushed out into about the best water in the river. It should be drawn inshore 15 feet.

HENRY JERVEY,
Captain, Corps of Engineers.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 21, 1899.

Respectfully submitted to the Secretary of War.

The board of public works of the city of Tampa, Fla., having requested the establishment of harbor lines for Hillsboro River at that place, the subject has been carefully considered by the local engineer officer, Capt. Henry Jervey, Corps of Engineers, and attention is respectfully invited to his report in first indorsement hereon.

Captain Jervey is of the opinion that the preservation of the harbor of Tampa requires the establishment of harbor lines, and he submits the accompanying map on which is delineated in blue the lines which in his opinion should be adopted. A description of the lines is also given in a separate paper.

I recommend that the lines selected be approved, and that the Secretary place his approval on the map which has been prepared for his signature.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

WAR DEPARTMENT, *August 26, 1899.*

Approved as recommended by the Chief of Engineers.

ELIHU ROOT,
Secretary of War.

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[1] Not printed.

PROPOSED DOCK LINES EAST SIDE OF HILLSBORO RIVER.

TAMPA, FLA., *August 3, 1899.*

Dock line begins at a point on the southerly side of Lafayette Street Bridge, 146 feet N. 67° 20′ E. from the central point of the southern edge of the bridge. (On the city chart submitted herewith this point is situated 346 feet westerly from the northwest corner of block 78, Jackson's survey.) From this point the dock line runs 594 feet S. 43° 30′ E. to a point on the central line (produced) of Washington street. (On the city chart this point is delineated at a distance of 171 feet westerly from center of sewer manhole at the intersection of Washington and Water streets.) Thence, the dock line runs 295 feet S. 28° 55′ E. to a point on the central line (produced) of Whiting street. (On the city chart this point is 173 feet from center of sewer manhole at the intersection of Whiting and Water streets.) Thence, the line extends 931 feet S. 10° 07′ E. to a point opposite the last turn in the eastern side of the channel. (On the city chart this point is delineated at a distance of 125 feet westerly from center of sewer manhole.) Thence, the dock line runs 357 feet S. 26° 55′ E. to the mouth of the river at outfall near water's edge.

The dock line on the easterly side of the river runs parallel to the proposed dredged channel and 15 feet outside of its edge.

PROPOSED DOCK LINES WEST SIDE OF HILLSBORO RIVER.

Dock line begins at a point on the southerly side of Lafayette Street Bridge, 172 feet S. 67° 20′ W. from the central point of the southern edge of the bridge. (This point, as shown on the city chart, forwarded herewith, is 668 feet westerly of northwest corner of block 78, Jackson's survey.) Thence, the dock line runs S. 43° 30′ E. for 666 feet; S. 28° 55′ E. for 200 feet; S. 10° 07′ E. for 963 feet, and S. 25° 42′ E. for 376 feet to the mouth of the river.

The dock line on the westerly side of the river runs parallel to the proposed dredged channel and 85 feet outside of its edge.

NOTE.—All bearings given are referred to the true meridian. The "central point of the southern edge of the bridge" is equidistant from the center of the capstone of the piers at the extremities of the swing span or draw. From Station A of United States Engineer's Survey, 1897 (Station A is at intersection of cross marks on granite curbstone 44.53 feet west of end of fixed span, west approach Lafayette Street Bridge, south side), the central point of the south edge of the bridge lies 275 feet N. 68° 48′ E.

APPENDIX R.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

REPORT OF CAPT. CLEMENT A. F. FLAGLER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Carrabelle Bar and Harbor, Florida.
2. Apalachicola Bay, Florida.
3. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.
4. Upper Chipola River, Florida, from Marianna to its mouth.
5. Flint River, Georgia.
6. Chattahoochee River, Georgia, and Alabama.
7. Choctawhatchee River, Florida and Alabama.
8. Lagrange Bayou, Florida, including Holmes River from Vernon to its mouth.
9. Pensacola Harbor, Florida.
10. Blackwater River, Florida and Alabama.
11. Escambia and Conecuh rivers, Florida and Alabama.
12. Alabama River, Alabama.
13. Coosa River, Georgia and Alabama.
14. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., July 26, 1899.

GENERAL: I have the honor to forward herewith annual reports of the river and harbor works under my charge * * * for the fiscal year ending June 30, 1899.

* * * * * * *

Very respectfully, your obedient servant,
C. A. F. FLAGLER,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

R 1.

IMPROVEMENT OF CARRABELLE BAR AND HARBOR, FLORIDA.

DESCRIPTION.

The town of Carrabelle is situated about 20 miles east of Apalachicola, on Carrabelle or Crooked River, which empties into the north side of the St. Georges Sound. The river forms the inner harbor, which has a channel along the water front of the town varying in depth from 9 to 15 feet, with a width of 100 feet.

A bar 1 mile wide from the 10-foot contour inside to the same depth outside, with a depth not more than 3 to 4 feet at low water, obstructs the passage in either direction.

PROJECT OF IMPROVEMENT.

The river and harbor act of June 3, 1896, appropriated $10,000, to be expended in making a 10-foot channel from the mouth of the Carrabelle River to the channel in the bay. The approved project for this work was worded, "In making a channel 10 feet deep and as wide as conditions will permit, through the bar at the mouth of Carrabelle River, Florida."

The act of March 3, 1899, appropriated $10,000 for continuing the improvement at Carrabelle Harbor, and the approved project for its expenditure provides for "Widening and lengthening the channel across the bar at the mouth of Carrabelle River, by dredging," as far as the amount appropriated will permit.

OPERATIONS TO JUNE 30, 1898.

Under contract with the Rittenhouse Moore Dredging Company, of Mobile, Ala. (approved June 11, 1897), the work of dredging a channel 10 feet deep and 53 feet wide was begun July 1 and ended August 7, 1897.

The dredging was commenced at a point bearing south 29 degrees east 850 feet distant from the lantern of the white-light beacon (old channel range) and continued along a course NW. by N. ¼ W., toward the city of Carrabelle. After digging 975 feet good water was reached, and the dredge was moved 850 feet along the same course toward the inner edge of the bar, where digging was resumed and 75 feet length of cut made before the appropriation was exhausted.

The total length of the two sections of channel dug was 1,050 feet, which involved the removal of 30,592 cubic yards of sand.

CONDITION OF IMPROVEMENT JUNE 30, 1899.

No examination has been made of this channel since May, 1898, but the cut of that time showed deepening. It has, probably, at least held its own.

It is extremely doubtful if the amount of dredging estimated in the report of the Chief of Engineers for 1898, page 1376, viz, 35,000 cubic yards, will be sufficient to almost double the width of the present cut and more than triple its length. From available data it appears that the portion of the bar remaining to be dredged has practically the same depth as that already worked over; a wider channel (100 feet, as proposed) will be better for commerce and doubtless cheaper per cubic yard, judging from the difficulties experienced in dredging a cut 53 feet wide. The amount estimated by my predecessor for completion of the existing project is $10,000. As I have no authority to increase the estimate, and $10,000 is now in hand, I make no further recommendation for the fiscal year ending June 30, 1901.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$10,000.00
July 1, 1899, balance unexpended	10,000.00

Appropriations.

June 3, 1896	$10,000
March 3, 1899	10,000
Total	20,000

The commercial statistics of Carrabelle Bar and Harbor are so combined with those of Apalachicola Bay that a separation is impossible, and reference is made to Apalachicola Bay for figures.

R 2.

IMPROVEMENT OF APALACHICOLA BAY, FLORIDA.

DESCRIPTION.

Apalachicola Bay is a long, broad, and shallow sheet of water on the south coast of Florida. It is separated from the Gulf of Mexico by St. Vincents Island, Sand Island, and the west half of St. Georges Island. The bay, when continued to the eastward, forms St. Georges Sound, which is separated from the Gulf by the eastern half of St. Georges Island, by Dog Island, and by Dog Island Reef.

The line dividing Apalachicola Bay from St. Georges Sound runs from Cat Point, on the north shore, to Bulkhead Point, on St. Georges Island. On this line is found Bulkhead Shoals.

Access to Apalachicola Bay can be had through West Pass, between St. Vincents Island and Sand Island.

The entrance to St. Georges Sound is through East Pass, between St. Georges and Dog islands.

Apalachicola Harbor is the deep water just inside of East Pass and north of Dog Island.

ORIGINAL CONDITION.

Apalachicola River enters Apalachicola Bay at about the middle of its north side. A bar exists at the mouth of the river. The depth of the water on it was originally about 3.5 feet. The width of bar between the 8-foot curves inside and outside varies; it averages 7,000 feet in round numbers.

The depth of water across Bulkhead Shoals was originally less than 4 feet.

PROJECT OF IMPROVEMENT.

The report of the examination of Apalachicola Bay is to be found in the report of the Chief of Engineers for 1879, page 823. This report recommended that a channel 100 feet wide and 11 feet deep should be dug through the bar at the mouth of the river. If the results obtained by this cut were such as to warrant its enlargement, it was recommended that the width be increased to 200 feet. This project was approved. The cost was estimated at $100,000.

A survey of the mouth of the river and of the eastern part of Apalachicola Bay was made in 1891. As the results of this survey the above project was again recommended, and to it was added the recommendation that a channel 9 feet deep and not less than 100 feet wide should be cut through the Bulkhead Shoals.

A survey of the western part of Apalachicola Bay was made in 1896, from the results of which a new project was made (report of the Chief of Engineers for 1897, pp. 1655-1659). This project was for the obtaining of a channel 18 feet deep at mean low water through West Pass, along the northern shore of St. Georges Island, and across the bay to the water front of Apalachicola. Estimated to cost $350,000 and $20,000 or $30,000 annually for maintenance of completed work. This project was not approved until June 13, 1899.

OPERATIONS TO JUNE 30, 1898.

The channel through the bar at the mouth of the river has never been obtained as recommended, owing to the insufficiency of appropriations. The width has never exceeded 100 feet. The depth has never exceeded 9.5 feet, as against 11 feet proposed.

The first cut was made during the winter of 1881 and 1882. It was begun at 11 feet inside the bar, and the depth of 11 feet was maintained for a length of 5,748 feet. Of this length 1,967 feet was 60 feet wide; 3,781 feet was but 30 feet wide. During 1883 the 30-foot cut was widened to 60 feet and extended to the 9.5-foot curve outside the bar. An additional cut 15 feet wide was made through the bar. Work done during 1884 left the channel in the following condition: Average depth, 9.5 feet; total length, 6,060 feet, of which 5,200 feet was 75 feet wide and 860 feet 60 feet wide. During the spring of 1885 the cut was partly reopened, it having filled up to an available depth of 6 feet. The reopening was made 4,177 feet long, 60 feet wide, and 9.5 feet deep.

During 1887 and 1888 the cut was reopened with the following dimensions: Length, 3,635 feet; width, 60 feet; depth, 9 feet.

An examination made in March, 1889, showed that the cut had shoaled to 4 feet in depth. The cut was reopened between November, 1889, and May, 1890, to a depth of 8 feet, with a length of 6,000 feet and a width varying from 80 to 90 feet. The cut was again reopened between November, 1892, and April, 1893, with these dimensions: 5,350 feet long, 120 feet wide at inner end, and 100 feet wide at outer end, 8 feet deep.

An examination made in April, 1894, showed that the channel had shoaled since the reopening, in 1892-93, 2.5 feet for a length of 2,000 feet near the inner end.

A new cut 4,930 feet long, 100 feet wide, and 8 feet deep at low water was dug during January and February, 1896.

In May and June, 1897, a channel 8 feet deep, 50 feet wide, and 5,500 feet long was redredged through the bar at the mouth of the river. This was the fifth time this channel had been reopened. The dimensions proposed for it by the approved project have never been attained.

A straight cut 4,000 feet long, 120 feet wide, and 9 feet deep was made across Bulkhead Shoals between October, 1891, and February, 1892, and up to the present date this channel shows no sign of filling.

There having been no funds available for work during the year, nothing was done.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No funds were available and no work was done.

CONDITION OF IMPROVEMENT JUNE 30, 1899.

No examination has been made of the existing channels since June 30, 1898, but I am informed that the channel across Bulkhead Shoals maintains its depth, while that through the bar at the mouth of the river is gradually shoaling.

PRESENT PROJECT.

The river and harbor act of March 3, 1899, appropriated $20,000 for improving Apalachicola Harbor, in accordance with the project last mentioned, through West Pass, and for maintenance. With the funds now available it is proposed to open a channel to the St. Georges Island anchorage.

RECOMMENDATIONS AND ESTIMATES.

The commerce of Apalachicola is large and would undoubtedly be much larger with better facilities. The present funds, $20,000, will open a channel to the St. Georges Island anchorage, but will probably not be able to secure the full width of 150 feet and will do little or nothing on the channel across the bar to the mouth of the river.

I recommend that the channel to St. George anchorage be given its full width of 150 feet and maintained at 18 feet depth, and that the channel to the city from this anchorage be completed to 11 feet depth and 200 feet width, as in the project of 1879.

The estimate is as follows:

Excavating 200,000 cubic yards, channel across river bar	$40,000
Widening of West Pass and Link channels	10,000
Maintenance, surveys, and range lighting	10,000
Total	60,000

which amount can be economically and profitably expended during the year ending June 30, 1901.

Money statement.

July 1, 1898, balance unexpended		$382.47
Amount appropriated by river and harbor act approved March 3, 1899		20,000.00
		20,382.47
June 30, 1899, amount expended during fiscal year		106.97
July 1, 1899, balance unexpended		20,275.50
July 1, 1899, outstanding liabilities		8.15
July 1, 1899, balance available		20,267.35
Amount (estimated) required for completion of existing project		330,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$50,000.00	
For maintenance of improvement	10,000.00	
		60,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following amounts have been appropriated from time to time for this bay:

March 2, 1833	$8,700	August 11, 1888	$20,000
July 4, 1836	10,000	September 19, 1890	20,000
March 3, 1839	9,900	July 13, 1892	20,000
June 14, 1880	10,000	August 18, 1894	15,000
March 3, 1881	10,000	June 3, 1896	12,000
August 2, 1882	25,000	March 3, 1899	20,000
July 5, 1884	10,000		
August 5, 1886	12,000	Total	202,600

These appropriations were divided into two periods, separated by an interval of forty-one years, viz, from 1833 to 1839, $28,600; from 1880 to 1899, $174,000.

COMMERCIAL STATISTICS.

The following report of the Board of Trade of Apalachicola, Fla., has been furnished by Mr. J. E. Grady, president:

"Apalachicola has 5,000 inhabitants, and is situated on the Apalachicola bay and river, into which empties the Chattahoochee and Flint rivers, on which three lines of steamers ply. On these rivers abound almost inexhaustible quantities of pine, cypress, and other valuable timber. At this port and near it are six large sawmills, with a capacity of 500,000 to 600,000 feet of lumber per day, and Apalachicola is the market for the logs to supply these mills. The great drawback to this trade and to Apalachicola is the long and perilous tow to Dog Island, across the rough and dangerous East Pass, a distance of about 25 miles. In addition to the great expense of towage and the loss of timber and lumber, and the delay caused by rough weather makes it almost impossible to successfully compete with other Gulf ports.

"Now the report and survey of Major Mahan, of September 17, 1896, for a channel 18 feet low water, West Pass to Apalachicola, is what is badly needed. There is no doubt but that this channel, within 7 miles of Apalachicola, would not only remain open, but would deepen. This channel would then avoid all towage to the eastward and avoid all risks and delays, and vessels could be loaded in less time than it now takes.

"Only a few months ago the representatives of two large enterprises came here to try and open up business which would require thirty to fifty vessels a year, but abandoned the idea solely on account of the towage to East Pass; but they stated that if West Pass was opened up within 7 or 8 miles of Apalachicola that they would open up business at once.

"In addition to the lumber business, Apalachicola is the outlet for Georgia and Alabama for all their heavy products—merchandise, and naval stores. The Georgia legislature, on August 13, 1887, and a convention of Alabama, Georgia, and Florida, held at Columbus, Ga., on March 9, 1887, both fully recognizing the great benefit that would be derived, asked Congress to open up and improve Apalachicola's West Pass entrance.

"The reports in 1860 show that Apalachicola's business amounted to $15,000,000, and that the revenue paid to the United States was more than the balance of the State of Florida. If this channel from the West Pass, within 7 miles of Apalachicola, is opened up it will increase the commerce of the port to a very large extent, and thereby yield to the United States a large revenue.

"With this statement is appended statement of commerce from custom-house records and board of trade information that I ask to be placed as a part of this report."

The following statistics have been furnished by Mr. William B. Sheppard, collector of the port of Apalachicola, Fla.:

	Number.	Tons.
Vessels entered from foreign ports	43	20,135
Vessels entered from coastwise ports	17	8,731
Total	60	28,866
Vessels cleared for foreign ports	38	20,905
Vessels cleared for domestic ports	40	16,037
Total	78	36,942
Vessels arriving which do not enter or clear at the custom-house	100	12,500
Vessels departing which do not enter or clear at the custom-house	110	13,500
Estimated arrivals and departures of steamers plying the Apalachicola, Flint, and Chattahoochee rivers	750	89,000
Number of small vessels engaged in the traffic of the port	160	....

Estimated amount of superficial feet of pine and cypress lumber shipped.	50,000,000
Oysters and fish shipped .... barrels..	10,000
Estimated value of the commerce of the port	$1,250,000

There is, besides, a large lot of traffic at Apalachicola in the purchase of logs, timber, and naval stores, that are not in the custom-house statistics, that can be safely placed at $1,000,000 more.

R 3.

IMPROVEMENT OF APALACHICOLA RIVER, THE CUT-OFF, AND LOWER CHIPOLA RIVER, FLORIDA.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The Apalachicola River is formed by the junction of the Chattahoochee and Flint rivers at the extreme southwest corner of the State of Georgia. It runs southwardly through the State of Florida and empties into the Apalachicola Bay at the city of Apalachicola. The annual overflow of this river caused by the freshets in the Chattahoochee and Flint rivers unfits the country directly along its banks for agricultural purposes; however, large quantities of timber are found on both sides of the river. The greatest obstacle to navigation was found at Moccasin Slough, 47 miles above Apalachicola. The Confederate States authorities drove piles across the river here to prevent the vessels of the United States from ascending the river; these piles caught logs, snags, and other floating material, completely blocking the river, and caused a new channel 3,100 feet in length to be cut about 1½ miles above the obstruction to the river Styx. This new channel was very narrow and crooked, only 80 to 100 feet wide, making navigation difficult. The depth of water in the channel from the junction of the Chattahoochee and Flint rivers to Apalachicola, Fla., is at all places more than 6 feet. Its length is about 105 miles, its width 150 to 200 yards. Winter freshets bring more or less logs and snags into this river from the rivers above.

PROJECT.

The original project, submitted in 1873, was to widen and straighten Moccasin Slough, at an estimated cost of $80,333. An act of August 11, 1888, directed an examination of the "Chipola River from its mouth to Wewahitchka, and the Cut-off, and Lee Slough, running from the Apalachicola River to the Chipola River." As a result of this examination, made in 1889, the orignal project was extended so as to include a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Lower Chipola River.

The present project calls for a channel 100 feet wide and 6 feet deep, and for a channel 60 feet wide and 5 feet deep in the Cut-off and Lower Chipola River, together with the removal of snags and other obstructions which are brought into the stream from time to time by its tributaries during freshets.

The amount expended to June 30, 1898	$59,025.90

OPERATIONS TO JUNE 30, 1898.

A complete synopsis of the work on this river from January 1, 1875, to June 30, 1895, will be found in the Report of the Chief of Engineers for 1896, Part II, pages 1348–1350.

1896.—No work was done for want of funds.

1897.—The snag boat *Flint* worked three months on the Apalachicola, the Cut-off, and Lower Chipola rivers, and removed 4,200 logs, trees, and snags.

1898.—The snag boat *Chattahoochee* went over the rivers and removed a large number of overhanging trees, logs, snags, and stumps.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

No work has been done as no funds were available.

CONDITION OF IMPROVEMENT JUNE 30, 1899.

The river was in fairly good condition over the entire length. Considerable trouble was had at the Cut-off, on account of the river being so narrow and crooked, boats having to work around several of the points, and as there are numerous stumps and logs on these points it makes navigation difficult and dangerous.

There is very deep water in this river, and it is partially obstructed during the high-water season by logs and snags drifting in the river.

RECOMMENDATIONS AND ESTIMATES.

It is recommended that snagging operations and the work of straightening the sharp bends in the section known as the Cut-off be continued, so that navigation may be made reasonably safe, with the small amount allotted. The steamer *Apalachee* struck a stump in the Cut-off on June 24, 1899, and sunk in 24 feet of water. She was valued at $25,000.

Estimates.

Removing snags, stumps, etc	$5,000
Straightening the Cut-off	10,000
Total	15,000

The existing project, as extended in 1888, contained no estimate of cost, and it being impracticable to compile any in time for this report, the estimated cost of completion is omitted from the money statement herewith.

Money statement.

July 1, 1898, balance unexpended		$474.10
Amount appropriated by river and harbor act approved March 3, 1899		3,000.00
		3,474.10
June 30, 1899, amount expended during fiscal year		171.67
July 1, 1899, balance unexpended		3,302.43
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	5,000.00	
		15,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

May 23, 1828	$3,000	July 5, 1884	$1,000
April 23, 1830	2,000	August 5, 1886	1,000
March 2, 1831	8,000	August 11, 1888	2,000
June 23, 1874	10,000	September 19, 1890	2,000
March 3, 1875	10,000	July 13, 1892	5,000
June 18, 1878	8,000	August 18, 1894	5,000
March 3, 1879	5,000	June 3, 1896	5,000
June 14, 1880	2,000	March 3, 1899	3,000
March 3, 1881	1,500		
August 2, 1882	2,000	Total	75,500

COMMERCIAL STATISTICS.

The section of country lying along the river is heavily timbered and depends almost entirely upon the river for transportation of its products of timber and naval stores, but the commerce of the stream is so combined with that of the Chattahoochee and Flint rivers that a separation is impossible, and reference is made to the Flint river for figures.

R 4.

IMPROVEMENT OF UPPER CHIPOLA RIVER, FLORIDA, FROM MARIANNA TO ITS MOUTH.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

This river flows southward from Marianna to the head of the Dead Lakes, an estimated distance of 65 miles. It has a general low-water depth of 5 feet, with a width varying from 60 to 200 feet. It is much obstructed by rock shoals, snags, and overhanging trees. The rock shoals are distant from Marianna 23, 29, 32, 37, and 45 miles, respectively. Three bridges—a road bridge at Marianna, a railroad bridge 2 miles below, and a road bridge 14 miles below—are obstructions; these bridges have headways above low water 17, 16, and 15 feet, respectively.

PROJECT.

An appropriation of $5,000 having been made by act of Congress March 3, 1899, was to be expended in accordance with project submitted. This project contemplates clearing out a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snag boat, drilling barge, and dump scow. (See Annual Report, Chief of Engineers, 1889, page 1417.)

The project for expenditure of the amount appropriated is:

> To clear the channel through the Dead Lakes from the cut-off to the head of the lakes of all snags, logs, and fallen trees, and mark the channel with prominent guides to indicate it, and to work upstream on that portion of the river, from the head of the Dead Lakes toward Marianna, removing such obstructions to navigation as may be met with and as far as the funds available will permit.

This project was modified by authority of the Secretary of War, under date of June 30, 1899, so far as to permit the work to begin at Marianna and work on that section down the river to Look and Tremble Shoal.

RECOMMENDATIONS.

It would be beneficial to Marianna to have an outlet by water, and the work should start at Marianna and go downstream, first removing snags, logs, and overhanging trees, and blasting through the lesser shoals; then go over the river and remove the larger rock shoals by blasting a channel through them, and contracting the waterway by jetties and dikes.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$5,000.00
July 1, 1899, balance unexpended	5,000.00
July 1, 1899, outstanding liabilities	24.80
July 1, 1899, balance available	4,975.20
Amount (estimated) required for completion of existing project	36,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriation.

March 3, 1899	$5,000

COMMERCIAL STATISTICS.

No commerce of importance is at present interested in this part of the river except during the cotton season. For years past an occasional trip would be made with a barge when a rise in the river would permit. Loaded with cotton the barge would drift down with the current. When unloaded it would be pushed back upstream with poles to Marianna. Sometimes several trips have been made during one season by this means.

The following statistics have been furnished by Mr. W. H. Milton, president of the Marianna and Gulf Transportation Company:

"We carried last season 320 bales cotton and some other freight. The members of our company absolutely controlled 1,800 bales of cotton, which we would have shipped via barge except for difficulties of navigation. We usually control much more cotton, last year's crop being very short. We think, with the river made navigable, with little obstruction, that we can control and ship down the Chipola from 4,000 to 6,000 bales of cotton, and handle probably nearly 1,000 tons of guano, large quantities of naval stores, and other freights. We would have carried more cotton last season, but sold cotton on rising market, and the time being limited within which to transport it, and not having a sufficient number of barges to carry it down the river, we could not handle it. Without obstructions in river we would have carried all of it.

"There are now four or more naval stores factories on Chipola River. A letter from Frink & Co. states that they shipped 400 barrels turpentine, 1,500 barrels rosin, and about $11,000 of other freights; also, that navigation would increase their output down the river. Kinard, Span & Hays inform me verbally that they are now shipping on Chipola River $5,000 worth of freights per month and that their business will more than double this year if the river is improved. I have been unable to obtain a response from the others, but know that one of the firms not heard from is larger than either of the above mentioned. I also know of more parties who are awaiting the result of the improvements on the river to commence work on turpentine farms. I am informed that other industries await the opening of the river."

Name and description.	Draft of water.		Number of round trips made and between what places.
	Light.	Loaded.	
	Inches.	*Inches.*	
Barge Marianna	6	18	3 round trips, from Marianna to Wewahitchka.

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	320	80
Miscellaneous	packages	810	10
Rosin	barrels	1,500	300
Turpentine	do	400	100
Total			490

The estimated value of the above freight in round numbers is $20,612.

R 5.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

DESCRIPTION.

The Flint River rises about 20 miles southwest of Atlanta, in Georgia, runs nearly due south, bending a little toward the eastward, and finally joins the Chattahoochee River at the extreme southwest corner of the State of Georgia. The junction of these two streams forms the Apalachicola River. A survey was authorized by the river and harbor act of June 10, 1872. The survey was begun at Albany, Ga., in November, 1872, and finished in May, 1873.

PROJECT.

The project for this work proposes a channel 100 feet wide and 3 feet deep at extreme low water from Chattahoochee, Fla., to Newton, Ga., a distance of 71¾ miles, at an estimated cost of $118,105, and from Newton, Ga., to Albany, Ga., a distance of 33¼ miles, at an estimated cost of $66,757, making a total of $184,862, for a distance of 105 miles. The river and harbor act of June 18, 1878, called for an examination of this river between Albany and Montezuma, Ga.; this examination showed that by removing logs, snags, and overhanging trees throughout the entire distance, 77 miles, would give a navigable channel for light-draft steamers throughout the greater part of the year. It was estimated that this work would cost $15,100.

The present project calls for a channel 3 feet deep, 100 feet wide, from the junction with the Chattahoochee River to Albany, Ga., an estimated distance of 105 miles, and a navigable channel for light-draft steamers at moderate stages of water from Albany to Montezuma, Ga., an estimated distance of 77 miles, to be secured by removal of snags and overhanging trees, cutting through the rock reefs and deepening sand bars by works of contraction and shore protection.

Amount expended to June 30, 1898	$203,427.20

OPERATIONS TO JUNE 30, 1898.

A summary of operations to June 30, 1895, will be found in the Report of the Chief of Engineers for 1896, Part 3, pages 1352–1354.

1896.—Nothing was done above Albany, Ga.

1896.—Below Albany, Ga., work was finished at Kennedy Shoals and begun at Sister Island, where it continued until funds were exhausted.

1897.—Above Albany, Ga., nothing was done.

1897.—Below Albany, Ga., the channel was finished through Sister Island, Buck and Dickersons, to Dry Bread Shoals, a distance of 3¼ miles.

1898.—No work done, as no funds were available; the plant was left in care of a watchman.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

This river is open to navigation the entire year from its mouth to Bainbridge, Ga., 30 miles, and from Kennedy Shoals to Albany, Ga., 36½ miles, but owing to rock reefs, snags, logs, and overhanging trees between Bainbridge and Sister Islands, 39 miles, navigation is impossible at extreme low water. Should sufficient money be given to improve this section by removing the above obstructions, navigation could be had the entire year from its mouth to Albany, Ga., a distance of 105 miles, and would afford an outlet to immense quantities of naval stores, timber, cotton, and general merchandise, which at present has no outlet, at a reasonable cost.

On a rise of 4 feet above low water, boats can now run the entire distance between Albany and its mouth. A new line of boats have been running for two years between Albany and Kennedys Shoals, 36¼ miles, all the year round, owing to the improvements made between these points, and whenever the stage of water was sufficient they would go through to Albany from the mouth of the river. Navigation on the upper portion is greatly interfered with by not being able to run all the year from Albany to the mouth of the river. From this point down to Apalachicola Bay navigation is uninterrupted the entire year.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

No work was done until June 7, when the drilling barge was repaired and work commenced at Albany, going downstream, removing a few isolated bowlders which were a menace to navigation.

CONDITION OF IMPROVEMENT JUNE 30, 1899.

The river is in good condition from its mouth to Bainbridge and from Newton to Albany except for a few scattered bowlders below Albany, which are now being removed, but on account of rock reefs it is only on a rise of 4 or 5 feet that boats can run from Newton to Bainbridge.

RECOMMENDATIONS AND ESTIMATES.

Owing to the importance of this river and the advantages that would be derived from uninterrupted navigation from Albany to Brainbridge, it is recommended that work be concentrated on that portion between Bainbridge and Newton. A low-water channel over this portion, together with work now in progress between Kennedys Shoal and Newton, will give low-water navigation from Albany to the Gulf.

The obstructions over this portion consists mainly of rock reefs and points, shoals and bowlders, and must be removed by drilling and blasting.

Thirty-five thousand dollars could be profitably and economically expended during the year ending June 30, 1901, in improving this portion of the river and maintenance of the river up to Albany.

The amount already expended being in excess of existing estimate, and having no authority for increasing the estimate, the amount required for completion of existing project is omitted from the money statement herewith.

Money statement.

July 1, 1898, balance unexpended		$2,572.80
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		7,572.80
June 30, 1899, amount expended during fiscal year		1,328.68
July 1, 1899, balance unexpended		6,244.12
July 1, 1899, outstanding liabilities		619.77
July 1, 1899, balance available		5,624.35
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$30,000.00	
For maintenance of improvement	5,000.00	
		35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897		

Appropriations.

For Chattahoochee and Flint rivers:

June 25, 1874	$25,000
March 3, 1875	25,000
August 14, 1876	20,000
Total	a 70,000
June 18, 1878	10,000
March 3, 1879	7,000
June 14, 1880	20,000
March 3, 1881	15,000
August 2, 1882	$25,000
July 5, 1884	20,000
August 5, 1886	20,000
August 11, 1888	20,000
September 19, 1890	20,000
July 13, 1892	15,000
August 18, 1894	8,000
June 3, 1896	8,000
March 3, 1899	5,000
Total	193,000

a Of this amount $18,000 was expended on the Flint River.

COMMERCIAL STATISTICS.

The commerce of this stream is principally cotton, naval stores, and lumber. There are great quantities of fine timber along the banks of this river, mainly pine, cypress, and hard wood.

When the river is made navigable from Albany to Bainbridge the entire year it will greatly benefit these industries, and new ones will spring up all along the river.

For the Flint River alone the following statistics have been received:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Inches.*			
Bessie Clary	84.20	12	24	2	Albany and Bainbridge	8
Maud Alma	85.00	18	30	2	do	

Number of trips between Albany and points below on river not stated.

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	4,000	1,000
Cotton seed	sacks	10,000	1,000
Fertilizers	do	10,000	1,000
Hides and skins	packages	100	5
Lumber	feet B. M.	100,000	200
Provisions	packages	100,000	5,000
Grain	sacks	10,000	1,000
Miscellaneous freight	packages	200,000	2,000
Live stock	head	50	30
Total			11,235

Estimated value of above freights, in round numbers, is $898,800.

The quantities above refer to that section of the river between Albany, Ga., and Newton, Ga.

Between Bainbridge and the mouth of the river the stream is used by the steamers plying the Chattahoochee and Apalachicola rivers, and for the commerce of this entire system of rivers reference is made to the following table:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Inches.*			
Apalachee	161.90	28	60	52	Columbus and Apalachicola, Fla.	6,718
C. D. Owens	230	24	48	30	do	4,500
Three States	126	17	42	30	do	3,500
J. W. Hires	127	20	42	24	do	3,000
Thetis	60	17	42		Miscellaneous schedule	250
Naiad	170	24	42	41	Columbus to Apalachicola, Fla.	4,360
Queen City	151	24	54	18	do	1,547
W. C. Bradley	175	20	42	3	do	397

Freight carried.

Articles.	Quantity.	Tons.
Cotton .... bales..	11,792	2,948
Cotton seed .... sacks..	10,278	1,027
Fertilizers .... do....	27,553	2,755
Hides and skins .... packages..	97	16
Live stock .... head..	805	183
Lumber .... feet B. M..	100,078	200
Staves	24,125	241
Provisions .... packages..	138,748	13,874
Grain .... sacks..	47,795	4,676
Miscellaneous freight .... packages..	808,220	30,822
Wool .... bales..	11	2
Brick	298,731	734
Turpentine .... barrels..	10,440	2,610
Rosin .... do....	41,131	8,226
Shingles	5,558,000	2,779
Cotton-seed meal .... sacks..	23,010	1,150
Sirup and honey .... barrels..	950	190
Melons	2,068	23
Boilers	8	54
Total	....	72,510

The estimated value of above freight in round numbers, $4,288,000.

In addition to the above, large quantities of timber are carried down these streams to sawmills near Apalachicola Bay, of which no value is given, as there seems to be some difficulty in keeping the amount of timber rafted down these streams; but its value is included in the general value of the commerce reported for Apalachicola Bay, Florida.

R 6.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA—GENERAL IMPROVEMENT.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The Chattahoochee River rises in the extreme northern part of Georgia, whence it flows southwardly until it strikes the boundary line between Georgia and Alabama at West Point, Ga.; thence due south, forming the boundary line between the States of Georgia and Alabama, and farther on its course, between Georgia and Florida, until it joins the Flint, forming the Apalachicola River. The river is not navigable until it reaches Columbus, Ga., an estimated distance of 224 miles above its junction with the Flint.

The obstructions between these two points were rock reefs, sand and gravel bars, logs, and snags; the greatest obstruction was between Columbus and Eufaula. Navigation was first attempted on this river in 1828.

The report of the survey of the Chattahoochee River, shown on pages 584–585, Report of the Chief of Engineers for 1872, contains an estimate for the improvement of the Chattahoochee and Apalachicola rivers from Columbus, Ga., to Apalachicola, Fla., at a cost of $164,000. No project is made in that report.

In the Report of the Chief of Engineers for 1873, page 700, three estimates were presented, as follows:

(1) For removal of snags, logs, and loose rocks, insuring a 4-foot channel between Eufaula, Ala., and the junction of the Flint at low water, $63,333.

(2) For straightening and widening this 4-foot channel to 100 feet, $81,914.

(3) For deepening this channel to 6 feet at low water, 100 feet wide, $982,945.

Estimates Nos. 1 and 2 were considered sufficient for the requirements of navigation.

This makes the estimated cost of improvement of this part of the river, $145,247.

PROJECT.

The project provides for a low-water channel 4 feet deep and 100 feet wide from Columbus, Ga., to Chattahoochee, Fla., an estimated distance of 224 miles, by the removal of snags and logs from the channel and overhanging trees from the banks, cutting a channel through the rock shoals and deepening sand and gravel bars by works of contraction and shore protection.

Amount expended to June 30, 1898	$309,393.10

OPERATIONS TO JUNE 30, 1898.

A summary of work done on this river from 1874 to June 30, 1897, is to be found in the Report of the Chief of Engineers for 1898, Part II, page 1388, and a report of work done during the year ending June 30, 1898, is to be found in the same report, pages 1388–1390.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

The river was navigable without much trouble at ordinary low water; however, during the extreme low water in the summer of 1897, trouble was had at the following places: Mary Freemans or Hospital Reach, Gunboat Bar, Mound Bar, Upatoie, Rock Island, Kings Rock, Bryants, Bigfoot Cove, Prestons, Wood Shoals, and at other places of not so serious a nature. Navigation on this river was for a time suspended. Some of the steamboats had to be left as they were, on the sand bars, until there was a rise sufficient to float them off. It should be remembered that the sand and gravel bars do not always remain in the same place on this river. A bar may give trouble for months and then change, and trouble will be met with where none has ever been found before.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

At the beginning of the year the plant was still tied up at Burdocks Landing, in charge of a watchman. The old drilling barge was drifted ashore during a period of high water, it being impossible to keep her afloat any longer. Owing to want of funds no other work was done until the appropriation made by act of March 3, 1899, became available, when the snag boat *Chattahoochee* was put in good condition and work started at Columbus, Ga., working downstream. At the end of the fiscal year she had removed obstructions between Columbus and Burdocks Landing.

CONDITION OF IMPROVEMENT JUNE 30, 1899.

The channel remains very much the same as it was in 1898, with the exception of more or less drift and snags collected at different places along the river.

RECOMMENDATIONS AND ESTIMATES.

It is recommended that all the old works of improvement be put in good repair, and that new works be constructed only at such points as may be necessary to afford relief to commerce during the next low-water season, as it is thought that the dredge boat to be built for this system of waterways will hereafter be able to keep the river open during the low-water season, thus doing away with works of contraction which, from the perishable nature of their construction, are mostly of a temporary character. The snag boats available for work in this river should be kept constantly at work when the water reaches the low-water stage, and the hulls of the pile-driver barge and flatboat should be rebuilt, to be available for rock excavation and pile work necessary at some of the bars requiring improvement.

The estimated cost of work contemplated for this river is as follows:

Removal of annual accumulation of snags, logs, etc	$5,000
Removal of bars, shoals, etc., by means of dredging	5,000
Rebuilding hulls of pile driver and flatboat	5,000
Repairs to various old works	20,000
Excavation and controlling the channel in and near St. Francis Bend, Rock Island, Kings Rock, etc	51,000
Total	86,000

which amount can be judiciously and advantageously expended during the fiscal year ending June 30, 1901.

No estimate has ever been made for that portion of this river on which the bulk of the work has been done, viz, from Eufaula, Ala., to Columbus, Ga., and the estimate for completion of the existing project is therefore omitted from the money statement herewith.

Money statement.

July 1, 1898, balance unexpended		$606.90
Amount appropriated by river and harbor act approved March 3, 1899		45,000.00
		45,606.90
June 30, 1899, amount expended during fiscal year		603.70
July 1, 1899, balance unexpended		45,003.20
July 1, 1899, outstanding liabilities		1,516.45
July 1, 1899, balance available		43,486.75
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$61,000.00	
For maintenance of improvement	25,000.00	
		86,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

February 24, 1835	$2,000
Chattahoochee and Flint rivers:	
June 23, 1874	25,000
March 3, 1875	25,000
August 14, 1876	20,000
Total	[1] 70,000
June 18, 1878	18,000
March 3, 1879	15,000
June 4, 1880	20,000
March 3, 1881	$20,000
August 2, 1882	25,000
July 5, 1884	35,000
August 5, 1886	20,000
August 11, 1888	20,000
September 19, 1890	20,000
July 13, 1892	[2] 25,000
August 18, 1894	[2] 30,000
June 3, 1896	[2] 25,000
March 3, 1899	[3] 50,000
Total	323,000

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[1] Of the joint appropriations $52,000 was expended on the Chattahoochee River.

[2] Of each of these appropriations $5,000 was to be expended between Westpoint and Franklin.

[3] Of this amount $5,000 was for survey from Westpoint to Franklin, or as much thereof as may be necessary.

COMMERCIAL STATISTICS.

The commerce interested on this river is chiefly cotton, naval stores, and general merchandise. This river runs through a section of country where there are but few railroads—none parallel with the river—and the people depend largely on the boats for their supplies. There is also a large passenger traffic on this river.

The commercial statistics for the Chattahoochee River are so combined with those of the Flint River that a separation is impossible, and reference is made to that river for figures.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA, BETWEEN WESTPOINT AND FRANKLIN.

DESCRIPTION.

This section of the Chattahoochee River is 38 miles long. It is divided into a series of pools, varying from one-half mile to 5 or 6 miles in length, by rock shoals and rapids, some of which have a fall as great as 8 feet in a mile. The width of the pools is from 300 to 500 feet, and their depth not less than 4 feet. The width of the stream at the shoals is from 800 to 1,000 feet, and the depth of water is only a few inches.

The river was originally not navigable over this section.

PROJECT.

The river and harbor act of September 19, 1890, provided for a preliminary examination of this section of the Chattahoochee. As a result of this examination, made November, 1890, it was recommended that a survey be made for the purpose of founding a project of improvement and estimate of cost. This survey was not made.

The river and harbor act of July 13, 1892, allotted $5,000 from the general appropriation for the Chattahoochee River to be spent on this section.

In response to a call for a project for the expenditure of this sum, the following was submitted on July 26, 1892:

To remove the lesser rock shoals, sand and gravel bars by excavation and works of contraction; to remove overhanging trees from the banks, and snags, logs, and other obstructions from the channel, and to overcome the more serious obstructions by the construction of locks and dams, to give a minimum depth of 3 feet at low water in the channel between Westpoint and Franklin, a distance of 38 miles.

Recommendation was made "that a party be organized for working the shoals between Westpoint and Bently Mill, and continue working until the shoals are put in as good condition as practicable, or until the funds are exhausted." These recommendations were approved August 5, 1892.

The amount expended to July 1, 1898, was $9,630.84.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

A low-water channel 50 feet wide and 3 feet deep has been obtained through Roberts, Flat Rock, and Haynes Island Shoals.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

No work was done during the year.

RECOMMENDATIONS.

No recommendations can properly be submitted until the survey provided for by the river and harbor act of March 3, 1899, is finished. Then data will be available upon which trustworthy estimates of cost can be based.

Money statement.

July 1, 1898, balance unexpended	$5,369.16
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
July 1, 1899, balance unexpended	10,369.16

Appropriations.

July 13, 1892	$5,000	March 3, 1899	$5,000
June 3, 1896	5,000		
August 18, 1894	5,000	Total	20,000

COMMERCIAL STATISTICS.

No statistics have been received of the commerce of this portion of the river.

R 7.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

ORIGINAL CONDITION BEFORE IMPROVEMENT.

Before work was commenced on this river the channel way was much obstructed by large and dangerous snags, by sunken logs, by overhanging timber, and by shoal bars, which consist of gravel and coarse sand.

This much obstructed channel way was not at all available for the amount of commerce which passed between Caryville, Fla., a station on the Pensacola and Atlantic Railroad, and the town of Geneva, Ala., which is entirely dependent on the river for the receiving and shipping of supplies and products.

PROJECT.

The project of the improvement of this river provides for obtaining a low-water navigable channel from the mouth of the river to Newton, Ala., an estimated distance of 162 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by excavating rock shoals, and by deepening sand bars by works of contraction and shore protection. This project was later amended, and authorized that no part of the money appropriated should be expended above Hollis's Bridge until a draw, approved by the Secretary of War, is put in said bridge. The present amended and approved project extends the improvement to Newton, Ala., and directs that of the $16,000 allotted by the last Congress $10,000 shall be expended between Geneva, Ala., and Newton, Ala. The amount expended to June 30, 1898, was $143,118.07.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

On June 30, 1898, the work accomplished under the approved project had secured a good navigable channel of 3½ feet at low water from Caryville, Fla., to Geneva, Ala., and varying in width from 60 feet to 120 feet, the narrow portions being confined to the bars, which have been deepened by contraction works.

As operations have been suspended during the fiscal year of 1899, obstructions brought into the channel by freshets have to quite an extent lessened the safety of navigation on low stages of water, and also compel the steamers to carry lighter loads.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

These consisted in caring for public property, there being no funds for active operations.

Owing to suspension of work during the fiscal year there has been no increase in depth.

RECOMMENDATIONS AND ESTIMATES.

It is respectfully recommended that the snag boat be kept at work each season removing such obstructions as are brought into the river during the high stages of water, and that the pile driver be employed for about two low-water seasons continuing contraction works at a few of the shoalest bars, and preventing caving banks by driving longitudinal rows of piles.

The character of the contraction works and bank protection employed have secured very satisfactory results, and their continuance is recommended. The sum of $24,000 can be economically expended on this improvement to June 30, 1901, $4,000 of which will be required for the construction of a new hull for the snag boat and proper barge in connection with the contraction work.

No estimate has ever been made for the project on this river; consequently no amount can be stated for completion of the existing projects.

Money statement.

July 1, 1898, balance unexpended		$758.55
Amount appropriated by river and harbor act approved March 3, 1899		16,000.00
		16,758.55
June 30, 1899, amount expended during fiscal year		826.50
July 1, 1899, balance unexpended		15,932.05
July 1, 1899, outstanding liabilities		86.94
July 1, 1899, balance available		15,845.11
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$20,000.00	
For maintenance of improvement	4,000.00	
		24,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

March 3, 1833	$5,000.00
June 15, 1844, for Choctawhatchee and Holmes rivers	10,000.00
June 25, 1874	5,000.00
March 3, 1875	5,000.00
August 4, 1876	5,000.00
March 3, 1879	5,000.00
June 14, 1880	7,000.00
March 3, 1881	10,000.00
August 2, 1882	18,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	$10,000.00
September 19, 1890	12,500.00
July 13, 1892	12,500.00
August 18, 1894	6,000.00
June 3, 1896	5,000.00
March 3, 1899	16,000.00
Total	162,000.00
Carried to the surplus fund, 1852	2,123.38
Balance	159,876.62

COMMERCIAL STATISTICS.

The Geneva Transportation Company, of Geneva, Ala., reports the following commercial statistics for the fiscal year ending June 30, 1899:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Inches.*			
Joe Davis	94	20	36	75	Geneva, Ala., and Caryville, Fla.	230
Ruth	42.5	18	36	135	do	265
Tudie Clark	29	16	30	150	do	
Do				22	Geneva, Ala., and Davis Landing.	
Eunola	84	18	36	45	Geneva, Ala., and Caryville, Fla.	85
Mattie				40	do	

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	6,200	1,550
Fertilizers	sacks	20,000	2,000
Cotton seed	do	900	45
Hides and skins	packages	40	10
Lumber	feet B. M.	15,000	30
Staves		10,000	200
Provisions	packages	25,456	1,536
Grain	sacks	24,520	1,839
Miscellaneous freight	packages	17,728	768
Hay	carloads	26	260
Barrels	empty	8,800	220
Turpentine	barrels	10,400	2,080
Rosin	do	31,500	8,125
Total			18,663

The estimated value of the above freight is	$1,000,000
The estimated value of logs and timber is	1,500,000
Total	2,500,000

R 8.

IMPROVEMENT OF LA GRANGE BAYOU, FLORIDA, INCLUDING HOLMES RIVER, FROM VERNON TO ITS MOUTH.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT WAS BEGUN.

Holmes River rises near the State line of Florida and Alabama, flows through Holmes and Washington counties, Fla., in a southerly direction, and empties into the Choctawhatchee River about 40 miles above its mouth. From the mouth of Holmes River up to the town of Vernon, Fla., an estimated distance of 28 miles, the stream is wide and deep, but was greatly obstructed by snags, logs, and fallen timber, and by overhanging trees on the banks.

This portion of the stream was only available for navigation by small sailing crafts and barges, which made occasional trips up to Vernon, Fla.

PROJECT.

By act of August 11, 1888, an appropriation of $3,000 was made to complete the improvement of La Grange Bayou, including Holmes River, as far as the town of Vernon.

In February, 1889, an examination of both La Grange Bayou and Holmes River was made, and this examination showed that the improvement could not be completed with the amount available, and the Secretary of War directed that no further expenditures should be made from these appropriations. The balance available was, therefore, returned to the Treasury.

The act of September 19, 1890, made an appropriation for improving La Grange Bayou, Florida, continuing the improvement of Holmes River, $3,000. Under this appropriation a project was approved for improving Holmes River, by removing logs and snags from the channel and overhanging trees from the banks, between the mouth and the town of Vernon, Fla.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

The amount expended on this portion of the improvement, up to the close of the fiscal year ending June 30, 1898, was $3,000, and resulted in clearing the channel of Holmes River of all obstructions that were then found. This work was done by using the plant belonging to the Choctawhatchee River. As there are no bars in that portion of Holmes River and its mouth, no works of contraction were built, the channel being of ample depth for the small commerce interested.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

No work was done during the year as no funds were available until March 3, 1899, when Congress appropriated the unexpended balance, $4,839.20, remaining in the Treasury for Holmes River from Vernon to its mouth. Under this appropriation it is proposed to remove such obstructions as may have accumulated since the river was worked on in 1898, this work to be commenced as soon as the high water on the Choctawhatchee prevents further work on that river.

RECOMMENDATIONS AND ESTIMATES.

When the work to be done with the amount at present available has been completed, it is probable that navigation will not again be impeded by snags, logs, and overhanging trees, and that the river will not require further improvement for some years, to meet the requirements of the small commerce interested. This improvement has no connection geographically with La Grange Bayou, Florida.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$4, 839. 20
July 1, 1899, balance unexpended	4, 839. 20

Appropriations.

June 15, 1844, for Choctawhatchee and Holmes River	$10,000
August 2, 1882, allotted from appropriation for Choctawhatchee River	2,000
August 5, 1886	2,000
August 11, 1888, to complete the improvement of La Grange Bayou including Holmes River, as far as the town of Vernon	3,000
September 19, 1890, improving La Grange Bayou, Fla.; continuing improvement of Holmes River	3,000
	20,000

Of this amount there was returned to the Treasury $4,839.20, which was re-appropriated by act of March 3, 1899.

COMMERCIAL STATISTICS.

In the Report of the Chief of Engineers for 1893, page 1706, Assistant Engineer J. E. Turtle reports:

"The commerce of Holmes River is increasing in shipment out, of cotton, molasses, fowls, and honey, while the necessary supplies for the inhabitants are beginning to be taken by water from Pensacola. The business has been done in flatboats and schooners, and it has been impossible to obtain reliable estimates of quantities. It is stated that a boat will be put on this stream during the fall of 1893, and I have confidence in its establishing a good trade.

"The value of the commerce for the fiscal year is roughly estimated at $12,000."

R 9.

IMPROVEMENT OF PENSACOLA HARBOR, FLORIDA.

ORIGINAL CONDITION OF THE NAVIGABLE CHANNEL.

On February 12, 1881, the date of the original adopted project for the improvement of this harbor, the available depth in the inner bar channel was 19.5 feet. The width of the channel way was also considerably contracted by the growth of the middle ground shoal to the south.

Years previous to the adoption of the project, the southern point of the middle ground was so far north that the width of the inner bar channel admitted sailing vessels in and out of the harbor, even during adverse winds.

In 1881 clearance under sail alone was seldom attempted, even on favorable winds, which practice was almost, if not entirely abandoned in 1885.

PROJECT.

There have been various projects for the improvement of this harbor, which briefly are as follows:

Project of 1877.—This project included only the removal of four wrecks.

Project of 1878.—This called for the removal of the above wrecks by contract; second, for a survey to determine further recommendations for improvements.

Project of 1881.—This project provided for dredging a channel 300 feet wide and 24 feet deep at mean low water across the inner bar for the temporary relief of navigation, and for protecting the shore line near Fort McRee from further abrasion, by the construction of groins and shore protection, with the view of preventing further injurious changes in the tidal currents and also of retaining the position for defensive purposes. Dredging under this project was carried on at various times between 1881 and 1893, and at several times the depth called for had been attained, viz, 24 feet at mean low water. Through lack of funds the prescribed width, viz, 300 feet, was never secured. In 1886 it was 120 feet wide and 24 feet deep, and at the close of the dredging under Rittenhouse Moore's contract in August, 1893, 225 feet by 24 feet.

The relief to the commerce of the port by dredging under this project, while it served a purpose, proved to be very unsatisfactory, as, owing to the conditions, mainly the location of the channel with reference to the middle ground, rapid and constant filling of the channel occurred; and, accordingly, a careful and extensive survey of the entrance was made in 1890, with a view of formulating a plan for an extensive and permanent improvement of the harbor.

Project of 1891.—This project was presented by a special board of engineers, July 16, 1891. Briefly, it provided for the abandonment of project of 1881 and the opening of a new channel across Caucus Shoals in the direction of the ebb currents by means of jetties, and by dredging, if necessary. No work was done under the recommendation of this board.

First amendment to the project of 1891.—A special board of engineers, appointed "to reconsider the project for the improvement of the harbor of Pensacola, Fla.," presented its report of August 20, 1895. This board made no change in the project of 1891. It recommended "that the engineer officer in charge be directed to take the necessary steps to secure immediately the use of one of the powerful hydraulic dredges now owned by the United States, and open a channel 26 feet deep at mean low water, and as wide as practicable on the line of the deepest water across Caucus Shoal, approximately on the line of the axis of the jetty channel recommended by the board of 1891, and that he be authorized to use for this purpose as much of the funds now available as may be necessary."

This report may be found in the Report of the Chief of Engineers for 1895, page 1657.

In 1895 the depth had shoaled to less than 21 feet, and in December of the same year was again opened by the U. S. dredge *Gedney* to 24 feet by 120 feet at mean low water. On May 31, 1896, this depth had shoaled to 20 feet at mean low water.

Second amendment to project of 1891.—This amendment was submitted by the same board that recommended the first amendment, one officer having been added to the board. It is as follows:

> 1. The board recommends that all funds now available be expended in continuing the work of dredging across Caucus Shoal.
>
> 2. If funds sufficient for the construction of a suitable dredge and for its operation for a period of at least two years be made available by the next river and harbor act, the board recommends that such a dredge be built and a channel be opened across Caucus Shoal at least 300 feet wide, having a least mean low water depth of 30 feet, with such side slopes as the material will assume.

Until a channel be opened by dredging across Caucus Shoal, as herein proposed, the board recommends that the construction of jetties for its economical maintenance be not further considered.

The existing conditions at the western end of Santa Rosa Island, and near Fort McRee, should however be maintained by the construction, if necessary, of suitable shore protection, which may be utilized as bases for jetties should their construction become imperative.

OPERATIONS TO JUNE 30, 1898.

The project of 1878 was accomplished by the removal of the wrecks by contract.

Operations in accordance with the project of 1881 were carried on at various times, as appropriations would admit, and at times the depth, 24 feet at mean low water called for, had been secured, but at no time was the channel made the required width—viz, 300 feet.

In 1886 it was 120 by 24 feet. In August, 1893, it was 225 by 24 feet.

In December, 1895, it had shoaled to 21 feet, and in the same month was opened by the U. S. dredge *Gedney* to 120 by 24 feet.

Since this no work has been done under the project of 1881, which, as stated, was abandoned in 1891.

Under the first amendment to the project of 1891, work was commenced by the U. S. dredge *Gedney*, belonging to New York Harbor Improvement, on October 25, 1895; it was continued until July 17, 1896.

At the close of the *Gedney's* work the Caucus Channel was 80 by 24 feet.

In April, 1897, under a contract with the Rittenhouse Moore Dredging Company, dredging was resumed April 20, 1897. Three hundred thousand four hundred and twenty-four cubic yards were removed; contract completed July 19, 1897, the channel being 85 by 23.4 feet.

Work under the second contract with the Rittenhouse Moore Dredging Company was commenced February 8, 1898, at which date the available depth was 22.8 feet at mean low water, and the width 100 feet. Under this contract 255,029 cubic yards were removed, and contract completed July 27, 1898. At its close the Caucus Channel south from its intersection with the inner bar channel (the McRee ranges) varied from 25.1 to 28 feet. North of this intersection was a small lump which was 24 feet at mean low water. This lump was left for the last part of Moore's second contract, but before this could be advantageously reached, war with Spain was declared, mines were placed on the lump, and dredging in this part of the channel had to be abandoned. Therefore the available depth in the channel at the close of the fiscal year 1898 was the depth on this lump, viz, 24 feet.

The project of 1881 called for the construction of two groins near old Fort McRee, for the retention of the shore line at this point. These were completed in 1890, have served the purpose intended, and remain in nearly perfect condition.

The total amount expended to July 1, 1898, was $491,180.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

At the beginning of the fiscal year work under the third contract with the Rittenhouse Moore Dredging Company was in progress. This contract closed July 27, 1898, the amount dredged being 36,242 cubic yards, and the available depth 24 feet. Work under the present contract was commenced February 8, 1899, and has continued until the present time, with comparatively slight interruptions, the amount dredged under this contract to June 30, 1899, being 334,405.5 cubic yards, making a total for the fiscal year of 370,647.5 cubic yards removed from the Caucus Channel. The available depth on June 20, 1899, was 25.8 feet. The average depth on the center range was 27.9 feet; on the range 75 feet east, 25.2 feet; on the range 75 feet west, 27.2 feet.

The expense directly attached to the improvement of the channel for the fiscal year was $72,393.69, which resulted in increasing the average depth to 27.05 feet, though the available depth only from 24 feet at mean low water to 25.8 at mean low water.

The expenses in detail are as follows:

Dredging	$64,642.37
Board of inspectors	241.00
Pay of inspectors	1,400.00
Lighting	275.00
Pay-roll employees	2,755.80
Printing	261.70
Advertising	130.42
Montgomery office	1,843.98
Miscellaneous	843.42
Total	72,393.69

Expended during fiscal year	55,981.32
Outstanding liabilities	987.70
Amount covered by uncompleted contracts	15,424.67
	72,393.69

RECOMMENDATIONS.

To complete the present adopted project, viz, a channel 300 feet by 30 feet at mean low water, requires the removal of 824,687 cubic yards, which, at the present contract price, calls for an expenditure, aside from inspection, of $123,703.05.

To complete a channel 250 feet by 30 feet requires the removal of 650,046 cubic yards and an expenditure of $97,506.90.

To complete a channel 200 feet by 30 feet requires the removal of 475,260 cubic yards and an expenditure of $71,289.

In securing 30 feet over a channel 300 feet wide by its present length, 12,520 feet, it will be impossible not to go below the 30-foot plane. In this event the 824,687 cubic yards will probably become 916,187 cubic yards, and likewise the 650,046 cubic yards for the 250-foot channel will become 724,157 cubic yards, and the 475,260 cubic yards for the 200-foot channel will become 531,877 cubic yards.

At the present contract price this last calls for an expenditure of $79,781.55.

In round numbers the available balance, not including the appropriation of March 3, 1899, is $86,500.

From these figures it would seem that a channel 200 feet wide can be secured under the present contract. This would leave 384,310 cubic yards to complete the project. Of this amount 166,000 cubic yards can be removed with the $10,000 remaining from the appropriation of March 3, 1899, after building the dredge authorized.

There will then remain to complete the project 218,300 cubic yards, which, at 6 cents, will require	$13,098.60
Maintenance, due to shoaling	10,000.00
Contingent expenses	10,000.00
	33,098.60
Or, in round numbers	35,000.00
For the Caucus Channel, and for dredging in the harbor in front of the city of Pensacola, Fla., to carry the depth of 30 feet to the established wharf line	70,000.00
Making a total of	105,000.00

that can profitably be expended to the end of the fiscal year June 30, 1901.

Money statement.

July 1, 1898, balance unexpended		$158,820.00
Amount appropriated by river and harbor act approved March 3, 1899		70,000.00
		228,820.00
June 30, 1899, amount expended during fiscal year		55,981.32
July 1, 1899, balance unexpended		172,838.68
July 1, 1899, outstanding liabilities	$16,412.37	
July 1, 1899, amount covered by uncompleted contracts	76,500.00	
		92,912.37
July 1, 1899, balance available		79,926.31
Amount (estimated) required for completion of existing project		105,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$95,000.00	
For maintenance of improvement	10,000.00	
		105,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

June 18, 1878	$20,000	September 19, 1890	$25,000
March 3, 1879	10,000	July 13, 1892	75,000
June 14, 1880	40,000	August 18, 1894	100,000
March 3, 1881	20,000	June 3, 1896	200,000
August 2, 1882	50,000	March 3, 1899	70,000
July 5, 1884	55,000		
August 5, 1886	20,000	Total	720,000
August 11, 1888	35,000		

COMMERCIAL STATISTICS.

The following information has been obtained from the collector of customs, port of Pensacola, Fla.:

Exports to foreign ports	$14,196,374
Exports to coastwise ports	742,710
Total amount of exports	14,939,084
Imports from foreign ports	56,637
Duties on imports and miscellaneous collections	42,103

	Number.	Tons.
Vessels entered from foreign ports	508	558,008
Vessels entered from coastwise ports	123	124,146
Total	631	682,154
Number of vessels employed in traffic of port:		
Steam	39	
Sail	123	
Total	162	

Coastwise exports.

	Quantity.	Value.
Lumber, at $10 per M ... feet B. M.	6,476,000	$64,760
Coal, at $5 ... tons	89,221	446,105
Phosphate, at $5 ... do	7,153	35,765
Shingles, at $4 per M ... M	520	2,080
Cross-ties, at $0.25 each ... M	776	194,000
Total		742,710

R 10.

IMPROVEMENT OF BLACKWATER RIVER, FLORIDA.

DESCRIPTION.

The Blackwater River rises in the southern part of the State of Alabama, near the Alabama and Florida State line, flows through Santa Rosa County, Fla., in a southwesterly direction, and empties into Blackwater Bay, one of the arms of Pensacola Bay. It is a deep stream from 12 miles above Milton, Fla., to its mouth, with the exception of a shoal known as Hunts Bar, one-half mile below the town of Bagdad, Fla. This shoal is a compact sand bar about 250 feet wide, with a depth of about 6 feet at mean low water, and extends obliquely across the river.

PROJECT.

An appropriation of $5,000 having been made available by act of March 3, 1899, being provided for expenditure in accordance with project submitted (see Annual Report Chief of Engineers, 1882, p. 1309), as follows:

(1) The reduction of one of the lumps known as the "Beer Garden."

(2) The dredging of a channel through the sand ridges, 100 feet wide, to a depth of 9 feet at mean low water (about 3 feet of dredging) and 2,500 yards long.

(3) The cutting of a channel of like width and depth through Hunts Bar.

The estimated cost is $20,000.

The project for expenditure of the amount appropriated for "cutting a channel 100 feet wide to a depth of 9 feet at mean low water (about 3 feet of dredging) through this bar," was submitted and approved April 10, 1899.

No money has been expended upon this work, as no appropriation has been heretofore available.

A depth of 6 feet at mean low water still remains available over Hunts Bar, which is the only obstruction to navigation between the deep water of the river and Blackwater Bay.

RECOMMENDATIONS AND ESTIMATES.

The obstruction known as Hunts Bar should be dredged to a depth of 9 feet, as this would enable vessels using the river to carry out larger cargoes of the products of the various sawmills on Blackwater River. This work will be undertaken by using the pumping plant and barges now on hand, as soon as they may be available for the work.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$5,000.00
July 1, 1899, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project........ Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	15,000.00

Appropriation.

March 3, 1899	$5,000

COMMERCIAL STATISTICS.

The commerce of this river consists principally of lumber and timber, which is carried to Pensacola, Fla., for export. It is quite large, but no information as to its amount or valuation has been received.

R 11.

IMPROVEMENT OF ESCAMBIA AND CONECUH RIVERS, FLORIDA AND ALABAMA.

DESCRIPTION.

This river flows through a sparsely settled section of Alabama and Florida, the adjacent country being heavily timbered with long-leaf yellow pine, and in the lower swampy sections with cypress. There is little or no farming carried on. Owing to these facts the river, aside from the transportation of timber and logs, has no commerce. Several attempts were made to establish a trade by light-draft steamers, but they have been failures. Therefore the object of the improvement has been carried on with a view of facilitating the large lumber trade.

ORIGINAL CONDITION BEFORE IMPROVEMENT.

Before work was commenced on these rivers the channel way was much obstructed by large and dangerous snags, by sunken logs and overhanging timber, making a rise of several feet necessary to the safe transportation of rafts, and was, therefore, poorly adapted to the demands of trade. The timber trade of these rivers forms a large part of the timber export of Pensacola, and in consequence of this obstructed channel way seagoing vessels were frequently detained at Pensacola.

Besides these obstructions mentioned, a shoal at the mouth of the river where it empties into Escambia Bay caused much trouble and delay in passing out of rafts.

PROJECT.

The originally adopted project provides for the improvement of the river from its mouth to Indian Creek in Alabama, an estimated distance of 293 miles, by the removal of logs and snags from the channel and overhanging trees from the banks, by excavating rock shoals, by deepening sand bars, by works of contraction and shore protection, and by dredging a channel through the bar at the mouth of the river.

There has been no change in this project. The character of the trade will probably never call for the protection of banks or the deepening of sand bars.

The amount expended on this river up to June 30, 1898, was $92,279.38.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

The object of the improvement is to keep open a channel such as will insure the safe passage of rafts and logs during low stages of water. This has been practically accomplished. Therefore the commercial advantages of the river have been provided for.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

Owing to lack of funds no active operations have been carried on. The rebuilding of the snag boat was commenced on May 25, 1899. The lumber has been delivered, and the framing of the gunwales and floor timbers well advanced. The work is being done by hired labor at Pine Barren, Fla.

RECOMMENDATIONS AND ESTIMATES.

Future operations upon this river will consist entirely of maintenance, and as it flows largely through an alluvial section, heavily wooded, there will always be as much as one snag boat can do.

It is recommended that the snag boat be employed during the low-water seasons in removing obstructions from the channel, in accordance with the approved project. For this portion of the improvement, $6,000 can be economically expended during the fiscal year ending June 30, 1901. The amount of timber and logs passing down this stream is enormous and justifies this expenditure.

As previously reported, the bar at the mouth of the river has shoaled and should be dredged; possibly the deepening of this bar is now the most important thing to be done. The channel over it should admit of boats going into the river for tows of timber; now, the rafts of timber have to be floated into the bay and there picked up by towboats. This depth should be 8½ feet, and the channel should be at least 100 feet wide, outlined with piling on either side, this to enable boats to pass out with tows of timber during moderately bad weather and during all stages of the tide. Twelve thousand dollars could be economically expended in dredging this bar during the fiscal year ending June 30, 1901, making a total for this improvement of the river of $18,000. The dredging should be done during the winter months by the snag boat fitted with pump and appliances, when the water is too deep for snagging.

No estimate has ever been made for the project on this river, consequently no amount can be stated for completion of the existing project.

Money statement.

July 1, 1898, balance unexpended		$220.62
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		5,220.62
June 30, 1899, amount expended during fiscal year		576.48
July 1, 1899, balance unexpended		4,644.14
July 1, 1899, outstanding liabilities		725.19
July 1, 1899, balance available		3,918.95
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$12,000.00	
For maintenance of improvement	6,000.00	
		18,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations.

For Escambia River:	
March 2, 1833	$5,000
July 2, 1836	5,500
June 14, 1880	8,000
March 3, 1881	5,000
July 5, 1884	3,000
For Escambia and Conecuh rivers:	
August 2, 1882	12,000
July 5, 1884	12,000
August 5, 1886	12,000
August 11, 1888	10,000
September 19, 1890	7,500
For Escambia and Conecuh rivers—Continued.	
July 13, 1892	$8,000
August 18, 1894	6,000
June 3, 1896	4,000
March 3, 1899	5,000
Total	103,000
Carried to the surplus fund 1838.	5,500
Balance	97,500

COMMERCIAL STATISTICS.

The commerce of this river is principally the transportation of logs, lumber, and timber, and is estimated to exceed $4,000,000 in value, or about 60 per cent of the export lumber trade of Pensacola, for the fiscal year ending June 30, 1899.

R 12.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

CONDITION BEFORE IMPROVEMENTS WERE BEGUN.

The original condition of the river was such that navigation was difficult and dangerous at all times, it being so obstructed by logs, snags, and fallen trees in the channel, by overhanging timber on the banks, and by bars and shoals, on many of which the low-water depth was only 2.5 to 3.5 feet, that safe navigation was practicable only by day during the low-water season. Long detentions were frequent at shoals below Selma, and traffic was suspended between Selma and Montgomery when the water was low.

PROJECT.

The original project for the improvement of this stream (see Report of the Chief Engineers for 1876, Part I, p. 498) contemplated making a channel 4 feet deep at low water, with a minimum width of 200 feet. This result was to be obtained by removing logs and snags from the channel, overhanging trees from the banks, cutting through rock reefs and gravel bars by blasting and dredging, deepening the channel across sand shoals and bars by works of contraction, and stopping the caving and washing of the banks by shore protection. The estimated cost of carrying out this project was $229,741.

First amendment.—The above project was amended (see Annual Report of the Chief of Engineers for 1891, Part III, p. 1761). The amended project differs from the original only in the depth to be obtained. This was put at 6 feet instead of 4 feet. The estimated cost of the amended project was placed at $386,251. Snagging operations and the maintenance of the increased depth when obtained were estimated to cost $10,000 a year.

There had been expended on this river, inclusive of maintenance and snagging to June 30, 1898, the sum of $343,797.29.

The condition of the river at that date was such that the stream was navigated by night as well as by day between Montgomery and Mobile during ten months of the year. During the remaining two months the lack of depth of water on the bars, upon which no works of improvement had been undertaken, prevented vessels from navigating the river higher than Hurricane Bluff, 52 miles below Selma, Ala., that part of the river between Selma and Montgomery being entirely abandoned in consequence of the low stage of the water.

The depth of water on several bars put under improvement has been increased by the completed works by 2 to 5.5 feet, and this increased depth maintained, the steamboats plying the river having no trouble in passing such points with full loads. The zero of the gauge, or the low-water mark of this river, was established in 1889 from information obtained from the pilots of the steamboat lines, from planters along the river, and from river men in Montgomery and Selma. This zero, or low-water mark, appeared to be very nearly correct until the fall of 1895. The autumns of 1896 and 1897 were periods of exceedingly low water. The river at Montgomery, in September, 1897, stood at 1.5 feet below the zero of the gauge, and at Selma at 2 feet below. This is the lowest water known in years. Boats were unable, therefore, to come above Hurricane Bluff, 204 miles above Mobile. During the month of June, 1898, the river at Montgomery, Ala., fell to 0.8 below the zero of the gauge, and at Selma to 1.3 below zero. This caused the head of navigation to be again established at Hurricane Bluff, 52 miles below Selma, but the condition only lasted a short while, as during the autumn of 1898 the river remained generally at such a stage as to afford good navigation throughout the balance of the low-water season.

The entire length of the river, so far as snags and overhanging trees were concerned, was in good condition when work was suspended in 1897, but no work having been done since that time, a large amount is now necessary to be done by the snag boat to remove the logs, snags, and other obstructions that have come into the channel during the high water of the spring of 1898 and 1899.

With the gauge at Montgomery reading zero, 3 feet can be carried over the shoalest place on that portion of the river between Mobile and Hurricane Bluff, a distance of 204 miles. Between Hurricane Bluff and Selma there are several shoals over which 2.5 feet only can be found, and between Selma and Montgomery are several upon which even a less depth than 2.5 is found. These shoals, however, have never been put under improvement.

OPERATIONS TO JUNE 30, 1898.

A brief account of the operations on this stream from 1879 to June 30, 1895, is given in the Report of the Chief of Engineers for 1896, Part III, pages 1397–1399.

A brief account of the operations during 1896, 1897, and 1898 is given in the Report of the Chief of Engineers for 1898, pages 1406–1408.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

The funds available for this improvement being practically exhausted on June 30, 1898, active operations were suspended prior to that date and were not resumed until the latter part of May, 1899.

The plant having laid up at Millers Ferry in September, 1897, in charge of the watchmen, and the experience of the winter freshet of 1897 and 1898 having demonstrated the fact that this point was an unsafe harbor, owing to the large amount of drift passing at times of freshets and shallow depth of water at low-water stages, as well as being inaccessible for proper supervision from the Montgomery office, the entire plant was moved up the river in August, 1898, and laid up opposite the city of Montgomery, Ala. No funds being available, except enough to pay the watchmen to end of the fiscal year of 1899, no work was undertaken until the appropriation approved by act of March 3, 1899, was made available. On March 27, 1899, a project for the expenditure of these funds—$50,000—was submitted and approved. As soon as this project was approved preparations were made to place the snag boat *Wm. J. Twining* in readiness to commence snagging operations and the removal of other obstructions from the channel. The snag boat was scrubbed, cleaned, and painted, and sundry repairs made to woodwork of hull and cabin, her machinery overhauled, and on the 23d day of May the steamer was put in commission. On the 2d of June she left Montgomery and commenced work in removing obstructions at Gauses bar, about 4 miles below Montgomery, working downstream towards the mouth.

At the close of the year the following shoals and bars had been cleared of obstructions:

Gauses Bar.
The Rocks.
Indian Town Bar.
Steeles Gin Landing.
Gardners Island.
Tarvers Chute.
Bar above Selma.
Cades Bar.
Watts Bar.
Moseleys Wood Yard.
Portland Shoals.
Canton Lower Bar.
Evans Upper Bar.
Gullets Gin.
Tates Bar.
Wilcox Bar.
From Shackleford Bar to the mouth of river.

Covering a distance of 293 miles below Montgomery, Ala.

Amount of work done and its cost.

Class of work.	Number.	Cost per unit.	Total cost.
Overhanging trees felled and cut up	22	$0.25	$5.50
Overhanging trees trimmed	299	.10	29.90
Logs cut up on bank	53	.25	13.25
Stumps cut level on bank	18	.57	10.26
Trees and snags removed from river	174	2.00	348.00
Logs removed from river, deadheads	26	.151	3.93
Trees removed from river (slip-ins)	78	2.14	166.92
Miles run by snag boat	391	1.15	449.65
Total			1,027.41

Total expenditures on account of snagging operations.

Engineering, superintendence, and labor	$747.57
Subsistence	176.41
Fuel	91.22
Engine supplies and lights	10.43
Stationery, medicine, etc	1.78
Total	1,027.41

No works of contraction for the permanent improvement of the river were built during the year, nor were any repairs made to those previously constructed, as the balance of funds available at the close of the fiscal year 1898 was only sufficient for the preservation and repair of the property during the year ending June 30, 1899.

The steamer *Coosada*, which had been laid up at Millers Ferry with the plant belonging to this improvement, was moved up to Montgomery, Ala., and laid up. The towboat *John Mills*, laid up at Montgomery, was not in service during the year.

CONDITION OF THE IMPROVEMENT JUNE 30, 1899.

Hurricane Bluff was, as in 1897, the head of navigation during the extreme low-water season of 1898, and steamboats made their regular weekly trips to that point.

All contraction works built since 1891 are still in fair condition, and the increase in depth caused by them is still maintained. The top layer of rock has been dragged off of a few dikes in places by passing drift and rafts, consequently they are below the required height in such places and should be repaired.

The season was excellent for snagging operations, but nothing was done on account of the small amount remaining available.

The condition of the working plant belonging to this improvement is as follows: The snag boat *William J. Twining*, which was overhauled and put in repair during the spring of 1897, is in fair condition and will be worked at snagging operations during this low-water season. Her hull, from the water line to plank-sheer, and parts of her main deck should be recalked, new cylinder timbers should be put under her main engines and two defective plates replaced in her boilers to enable her engines to work up to their full capacity. She now carries only 135 pounds of steam in the steam gauge, as compared with 160 pounds when working with her boilers in good condition.

The towboat *John Mills*, purchased in 1895, is in fair condition, but the vessel should be docked, the iron sheathing on her hull removed, and her top sides and deck recalked. Her wheel has been dismantled and will be immediately overhauled and all defective parts removed.

The steamer *Coosada*, which was purchased in 1891-92 for the Lower Coosa River, and turned over to and repaired at the expense of this improvement, was an old boat when bought and is now nearly gone. Her hull should be rebuilt, as it is very rotten and can not be kept afloat much longer without constant pumping.

The snag boat built in 1886 for the Tallapoosa River was transferred to the Alabama on the abandonment of the improvement of the former river in 1892. This boat was used for two seasons as a snag boat, and during 1895 and 1896 as a quarter boat by the survey party. The boiler, steam capstan, and all ironwork of any value have been removed from her and the boat has been beached on the shoal below Millers Ferry, as it was impossible to keep her afloat without constant pumping, day and night.

Pile driver No. 1 was the snag boat built in 1890 for the Cahaba River improvement, and when that work was abandoned in 1892, the snag boat was transferred to the Alabama and used as such during one season. It was then changed into a pile driver and used for two seasons; since 1895 it has been utilized as a quarter boat for the dike gang. The boat is in pretty fair condition except the deck, which was partially renewed during the fall of 1897. With some additions to and a few changes in the cabin arrangements it will make an excellent quarter boat for the survey party, as it is of light draft and readily handled.

Pile driver No. 2, built in 1893, is in fair condition, and all machinery in good working order.

The hulls of the two quarter boats, built in 1892, are thoroughly decayed and are not worth repairing. One of them sank twice during 1897; it was raised and towed to a point three-quarters of a mile above Millers Ferry and there abandoned.' The other one may possibly last through another year. The two stone barges, and the two small pile barges, all built in 1892, have been worn out by constant service and are now no longer suitable for transporting material any distance, but can be utilized for a while longer as lighters at the site of the works. The two stone barges built in 1893 are still in fair condition and will probably last one more year. The skiffs, tools, and general outfit are in good condition.

The following statement shows the total expenses incurred during the fiscal year ending June 30, 1899:

Cost of snagging operations	$1,027.41
Care and preservation of plant:	
Labor	953.84
Lights	7.48

Miscellaneous:	
Repairs to snag boat *Wm. J. Twining*	$81.09
Outfit for snag boat *Wm. J. Twining*	250.36
Materials for snag boat *Wm. J. Twining*	208.00
Medicines for snag boat *Wm. J. Twining*	3.57
Fuel for snag boat *Wm. J. Twining*	57.00
Subsistence for snag boat *Wm. J. Twining*	78.81
Ice for snag boat *Wm. J. Twining*	4.00
Repairs to towboat *John Mills*	177.88
Lumber for towboat *John Mills*	78.78
Previous liabilities paid during the year	152.79
Expenses Montgomery office	200.00
Outstanding unpaid labor	201.34
Total	3,482.35
Amount expended during the fiscal year	2,354.87
Amount outstanding liabilities June 30, 1899	1,127.48
	3,482.35

RECOMMENDATIONS AND ESTIMATES.

The importance of knowing what has become of the material removed by contraction works is evident. In many cases on the river it is known to form bars a short distance below the contraction, but the details of these formations are not known for want of surveys. I do not consider it possible to form a suitable project for the entire river without a complete survey of some degree of detail. Until such survey is made, I recommend that the work of improvement be restricted to snagging and dredging operations, and maintenance of present contraction works.

For a reasonable understanding of the physical conditions of the river, a survey would be required, costing at least $200 per mile, or $62,000. I do not think that the present commerce, however, justifies the expense of such a survey.

I agree with my predecessor, Major Mahan, in the belief that there is not water enough in the river to secure a low-water depth of 6 feet at the low-water stage.

A dredge and two small dump scows will soon be purchased for the river, and a snag boat and towboat are now on hand, and I respectfully recommend that the construction of permanent works of contraction be abandoned for the present, and an attempt be made to secure a clear channel 4 feet deep at mean low water and with a minimum width of 150 feet from Montgomery to the mouth of the river, by snagging and dredging. I do not advise change of existing project for a 6-foot depth, but simply a temporary channel, which will satisfy the present needs of commerce and serve to determine the practicability of a 6-foot channel with the low-water volume of water.

It is estimated that $15,250 can be profitably expended during the year ending June 30, 1901, in addition to funds then remaining on hand from the appropriation of March 3, 1899.

The estimate is divided as follows:

Operating snag boat	$7,000
Operating dredge and towboat	8,750
Maintenance of contraction works	5,000
Montgomery office expenses	2,500
Repairs to plant and care of property	4,200
Pay of assistant engineer	2,100
Total	29,550
Estimated amount remaining from appropriation of March 3, 1899	14,300
Balance	15,250

Which amount can be profitably and economically expended during the fiscal year ending June 30, 1901.

Money statement.

July 1, 1898, balance unexpended	$1,202.71
Amount appropriated by river and harbor act approved March 3, 1899	50,000.00
	51,202.71
June 30, 1899, amount expended during fiscal year	2,354.87
July 1, 1899, balance unexpended	48,847.84
July 1, 1899, outstanding liabilities	1,127.48
July 1, 1899, balance available	47,720.36
Amount (estimated) required for completion of existing project	196,251.00
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	15,250.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

June 18, 1878	$25,000	September 19, 1890	$20,000
March 3, 1879	30,000	July 13, 1892	70,000
June 14, 1880	25,000	August 18, 1894	50,000
March 3, 1881	20,000	June 3, 1896	40,000
August 2, 1882	20,000	March 3, 1899	50,000
July 5, 1884	10,000		
August 5, 1886	15,000	Total	395,000
August 11, 1888	20,000		

COMMERCIAL STATISTICS.

The following statement of the business done by the steamboats named below during the fiscal year ending June 30, 1899, has been compiled from statements made by Capt. John Quill, of the steamers *Nettie Quill* and *Carrier*, and by Capt. T. H. Moore, of the People's Line of steamers, plying between Mobile and Montgomery. No report was rendered by the captain of the steamer *Alto*:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Passengers carried.	Between—
		Light.	Loaded.			
		Inches.	*Feet.*			
Nettie Quill	299	29	6	38	2,917	Mobile and Montgomery.
Tinsie Moore	198.29	30	5	14	4,698	
City of Mobile	209	22	5	35		
Carrier	140.88	24	5			
Alto	363.16	80	7			
Barge Tide	320	10	3			
Barge Wave	320	10	3			
Barge Nellie	320	10	3			
Barge Mary	320	10	3			

Articles.		Quantity.	Tons.
Cotton	bales	50,841	12,710
Cotton seed	sacks	96,855	9,685
Fertilizers	do	53,765	5,376
Hides and skins	packages	1,025	170
Live stock	head	2,861	1,716
Lumber	feet, B. M.	681,308	1,362
Staves		450,830	4,503
Provisions	packages	130,005	13,500
Grain	sacks	135,950	12,080
Miscellaneous freight	packages	90,968	9,100
Brick	M	200,125	500
Turpentine	barrels	1,250	325
Rosin	do	12,187	2,437
Shingles	bundles	4,300,000	2,150
Cotton-seed meal	sacks	18,500	925
Wool	bales	200	40
Total			76,529

Estimated value of above freight, in round numbers, $6,887,610.

In addition to the commerce carried on by the above boats, there was a large increase in the rafting business on this river. Very great quantities of sawn and hewn timber, saw logs, lumber, and cord wood are rafted to Mobile annually, but available records of this business are not kept, but its estimated value is $2,500,000.

R 13.

IMPROVEMENT OF COOSA RIVER, GEORGIA AND ALABAMA.

1. BETWEEN ROME AND THE EAST TENNESSEE, VIRGINIA, AND GEORGIA RAILROAD BRIDGE.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The Coosa River is formed by the Oostenaula and Etowah rivers, which have their source in the mountains of northern Georgia. The town of Rome, Ga., is situated at their junction. The Etowah is not navigable. The Oostenaula is formed by the junction of the Coosawattee and Conasauga rivers, 60 miles northwest of Rome. The Oostenaula and its tributary, the Coosawattee, are navigable for light-draft boats the year round from Rome to Carters Landing, a distance of 105 miles. These rivers have been improved by works of contraction and channel excavation. There would be a continuous water route of transportation from Carters Landing to Mobile, Ala., an estimated distance of 815 miles, but for the shoals and rapids on the Coosa River, distributed over 142 miles, from Greensport, Ala., to Wetumpka, Ala. This water route includes the Coosawattee, Oostenaula, Coosa, Alabama, and Mobile rivers.

Prior to 1823 the legislature of Alabama passed "An act to improve the navigation of the Coosa River, and to aid in its connection with the Tennessee waters." In 1824 this act was formally approved by Congress.

In 1828 Congress provided that any surplus of the grant for improving Tennessee River should be applied to the improvement of the Coosa, Cahaba, and Black Warrior rivers.

It is not probable that much, if anything, was done under these acts, although steamboats have been plying on the upper Coosa for some thirty years. (See Report of the Chief of Engineers for 1881.)

Between Rome, Ga., and Greensport, Ala., an estimated distance of 173 miles, the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable.

From Greensport, Ala., to Wetumpka, Ala., a distance of 142 miles, the improvement will require the building of locks and dams in conjunction with channel excavation and works of contraction.

PROJECT.

The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean by the way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "Southern Route." The low-water depth and width of the channel proposed can not be stated from the records at hand.

Various surveys and examinations were made between the years 1870 and 1890 of the part of the Coosa under consideration—i. e., from Rome, Ga., to the Selma, Rome and Dalton Railroad Bridge, now known as the East Tennessee, Virginia and Georgia Railroad Bridge (hereafter in this report the latter designation will be used), an estimated distance of 245 miles. The following list gives the data of each and the estimates based upon them:

1870.—An examination from Greensport, Ala., to the East Tennessee, Virginia and Georgia Railroad Bridge, a distance of 72 miles. Estimated cost of improvement, $417,726.75.

1872.—A survey from Greensport, Ala., to the railroad bridge. No record can be found.

1874.—A survey from Rome, Ga., to the mouth of Wills Creek, 2½ miles below Gadsden, Ala., an estimated distance of 137 miles. Estimated cost of improvement, $180,000.

Summing up.—The total estimated cost of the improvement, determined from the above-described surveys, is as follows:

From Rome, Ga., to the mouth of Wills Creek, in Alabama, an estimated distance of 137 miles	$180,000.00
From Greensport, Ala., to the East Tennessee, Virginia and Georgia Railroad Bridge, an estimated distance of 72 miles	417,726.75
Total	597,726.75

The estimated cost of the improvement from Rome, Ga., to the railroad bridge is given in the Report of the Chief of Engineers for 1877 as follows:

From Rome, Ga., to Wills Creek, in Alabama, an estimated distance of 137 miles	$81,679
From Greensport, Ala., to the railroad bridge, an estimated distance of 72 miles	470,668
Total	552,347

No survey has been made nor has an estimate been submitted for the improvement of that section of the river between Wills Creek and Greensport, Ala., an estimated distance of 36 miles. The only improvement here was made at Leota Reefs, about 1 mile above Greensport.

1890.—A survey from Lock 4, situated at the foot of Broken Arrow Shoals, to the East Tennessee, Virginia and Georgia Railroad Bridge, a distance of 48 miles. Estimated cost of improvement, exclusive of the cost of Lock No. 4, $945,145.

The contemplated improvement was to be made by works of contraction at the lesser obstructions and locks and dams at the greater.

The estimates for locks and dams were made for structures with crib-chamber walls filled with loose stones and masonry head-and-tail walls laid in cement. The dimensions of the locks were 200 feet between miter sills and 40 feet wide. Before the building of the locks was begun the length between miter sills was changed to 210 feet, and it was decided to build masonry structures laid in cement throughout. It was proposed to secure a low-water channel 3 feet deep and 80 feet wide. Below Lock 3 the width and depth were afterwards changed to 100 feet and 4 feet, respectively.

By an act of Congress approved July 13, 1892, the restrictions as to the size of the locks imposed by the act of Congress approved September 19, 1890, were removed.

Beginning with Lock No. 4, the size of the remaining locks was increased. It is now, length over all, 400 feet; length between miter sills, 322 feet; width, 52 feet; depth over sills, 7 feet.

The channel improvement from Lock No. 4 to the East Tennessee, Virginia and Georgia Railroad Bridge now contemplates a low-water depth of 7 feet and a width of 100 feet.

The present plan of improvement was adopted in accordance with the recommendations contained in the reports of the various examinations and surveys, which are printed in the Annual Reports of the Chief of Engineers for 1871, 1872, 1875, 1878, 1881, 1890, and 1892.

The change from cribs to masonry and the later increase in the dimensions of the locks, the increased width and depth of channel, have added to the estimated cost of the improvement.

Amount expended to the end of the fiscal year ending June 30, 1898, was $949,183.85.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

By new works of contraction and the renewal of old ones at Horseleg Shoals, by dredging and the removal of sunken logs from the channel at Shorters Island and Mayos Bars, the river near Rome, Ga., except at Horseleg Shoals, where further work is needed, was made navigable the year round for the boats now in service on the river.

Sand and gravel for concrete were dredged from channels at McCoy Island and Box Shoals, and the channel at those obstructions was benefited by the amount of material removed.

At Lock No. 4 the concrete floor and wall foundations were finished within the limits of the present cofferdam. Following is a brief summary of the work done and the amounts expended thereon:

Channel work:	
Between Rome, Ga., and Cedar Bluff, Ala	$2,842.80
Box Shoals, dredging	204.60
Concrete floor, Lock No. 4	27,031.84
Miscellaneous	5,968.11
Recording gauge, Lock No. 5	60.00

Except at the obstructions named, where work was done, the channel remains substantially as at the end of the previous year.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1899.

Horseleg Shoals, near Rome, Ga., are 2,000 feet long, with a fall of 3 feet in that distance, and are made up of a succession of solid rock reefs, with a low-water depth of 1.5 feet over them. A channel was cut through these reefs and works of contraction built, probably in 1877. (See Report of the Chief of Engineers for 1896, Part III, p. 1409.) The enormous expense of further deepening the channel by excavation is prohibitive, and, if undertaken, would be of doubtful benefit to navigation, for such a cut would probably draw the water off the shoals above and seriously injure the harbor at Rome. It was therefore decided to build a number of wing dams at the foot of the shoals to distribute the fall over as great a distance as possible and to build a parallel dam near the west bank, running the entire length of the shoals, and from the west bank of Horseleg Island a succession of low wing dams, and thus contract the channel to a width of about 100 feet. This concentration of the flow of the river into so contracted a channel, it is hoped, will give a low-water depth of 3 feet and, of course, would render it necessary for boats to warp through going upstream during low-water periods, if this was not already the case. This condition is provided for in the construction of the parallel dam which is being built 4 feet above low water and provided with ring bolts every 150 feet of its length. During the year a total length of dam of 1,040 linear feet was built, 7 feet wide and of an average depth of 6 feet. The dams are cribs filled with broken stone.

Many of the shoals are deposits of gravel, in some places formed by eddies due to the formation of the channel and at others by eddies which occur immediately below rock reefs, either concealed or showing. The former deposits are removed entirely by dredging; the latter by dredging the gravel and blasting and dredging the reefs. In dredging operations on this river it has been found by experience extending over a period of seven years that the dredged material, when composed of gravel or blasted stone, can be deposited on the sides of the dredged cuts without again collecting in the channel. In dredging the full width of the 100-foot channel the dredged material is moved twice, except from the cuts along the edges. This double handling is more economical, however, than removal by barges, when all the expense of the first cost of barges, operation, and deterioration is considered.

Dredged cuts were made through gravel bars of the first-named kind at a small bar below Shorter Island (no name), Prices Lower, Palestine, and Beech Tree Creek Shoal. At Wilkinson Bar the cut was through soft shales.

Below Lock No. 3.—Just below the entrance to Lock No. 3 the channel was dredged. At Fomby Island Reef blasting through the rock reefs was finished, and dredging was in progress at the end of the fiscal year. At Whiteside Bar the work of building works of contraction was in progress.

In the spring of 1897 a break 300 feet long occurred in Dam No. 4. The break was temporarily repaired by driving sheet piles along and against the upper face and bracing them from below. The braces were sheathed, to prevent drift from getting under and carrying them away. This temporary work has been made more permanent by removing the sheathing from the braces and placing heavy stones of from 1 to 2 cubic yards in volume between and below them. Thus the sheet piles along the face are backed up with heavy stones.

The wave action below Dam No. 4 had caused a bad washout in the bank just below the west abutment of Dam No. 4. This was filled with stone.

Extensive repairs were made to the boilers, hull, and upper works of the towboat *Leota*.

Repairs were made to the machinery, dipper, boom, and A-frame of the dredge.

During the high water of March, 1899, a bad break occurred in the upper end of the cofferdam at Lock No. 4, which acts, while the lock is under construction, as part of the main dam. The break has been repaired and that part of the cofferdam is in excellent condition.

Watchmen have been constantly in charge of the Government property stored at Lock No. 4. The buildings and property there have been kept in good repair.

The following statement shows the expenditures for the fiscal year ending June 30, 1899:

Between Rome, Ga., and Cedar Bluff, Ala.: Building 1,040 linear feet of wing dam at Horseleg Shoals and dredging shoals between Horseleg and Prices Bar (no name), Prices Lower, Palestine, and Wilkinson bars, and Beech Tree Creek Shoals	$6,315.30
Channel work between Locks Nos. 3 and 4:	
Dredging just below the entrance to Lock No. 3	59.45
Blasting and dredging at Fomby Island Reef	291.51
Building dams at Whiteside Bar	846.94
Repairs to Lock No. 4: Main dam, cofferdam, and filling below west abutment	2,651.78

Miscellaneous:		
Repairs to towboat		$1,145.38
Repairs to dredge		556.27
Preservation and care of property, Lock No. 4		1,792.35
Recording gauge, Lock No. 5		60.00
Engineering and superintendence		702.16
Expenses not chargeable to any special work		72.12
Expenses Montgomery office		1,113.04
Unexpended material on hand June 30, 1899	$14,321.77	
Addition to plant	169.28	
		14,491.05
		30,097.35

Disbursements July 1, 1898, to June 30, 1899	14,512.00	
Less obligations due June 30, 1898	2,031.66	
		12,480.34
Unexpended material on hand July 1, 1898		14,457.97
Obligations due June 30, 1899		3,159.04
		30,097.35

RESULTS OF WORK DONE DURING THE YEAR.

The first 20 miles below Rome, Ga., except at Horseleg Shoals, were made navigable for boats drawing 3 feet the year round. At Horseleg Shoals navigation has been greatly benefited, and with the completion of the dams, as previously described, boats of 3 feet draft can pass that obstruction at all times.

Except the unfinished channel work, already described, all other work was confined to maintaining works of improvement already built or under construction.

The work was carried on by hired labor.

RECOMMENDATIONS AND ESTIMATES.

The amounts needed to construct Lock and Dam No. 5, to complete work at Lock No. 4, and channel work between Locks Nos. 3 and 5 are as follows:

Lock No. 4:	
Extension of cofferdam	$4,830.00
Repairs and additions to plant	14,000.00
Finishing concrete floor	20,000.00
Masonry of lock walls	58,647.40
Gates, valves, maneuvering machinery, etc	12,000.00
Excavation and paving below lock	15,000.00
Longitudinal dam and guide-crib above lock	12,000.00
Removing cofferdam, filling behind land wall, tearing down temporary buildings, and grading yards	15,000.00
Contingencies, 10 per cent	17,647.74
Total for No. 4	169,125.14

The dam at Lock No. 4 was greatly damaged during the winter of 1896–97 by logs passing over it. A large breach was made near the center. To repair this breach and raise the dam 3 feet, as approved, will cost $32,000.

The dredging and blasting in the channel between Locks Nos. 3 and 4 will cost:

At Box Shoals	$13,475.00
At McCoy Island Reef	1,000.00
At Alligator Reef	6,222.00
At Fomby Reef	1,500.00
At Hunnicutt Reef	2,000.00

At Whiteside Bar	$2,500.00
At Lonnergan Reef	4,000.00
Total for channel work	30,697.00
Deduct $20,000 appropriated by the river and harbor act of March 3, 1899, less $2,000 for preservation and care of property	18,000.00
Total for channel work	12,697.00
Lock No. 5:	
Cofferdam	$14,210.00
10,450 cubic yards concrete, at $7	73,150.00
107 cubic yards quoins, at $25	2,675.00
8,000 cubic yards earth excavation, at 78 cents	6,240.00
7,000 cubic yards rock, at $2.39	16,730.00
Lockhouse	3,000.00
Plant	25,000.00
Dam	40,000.00
Abutment	24,000.00
Total	205,005.00
Contingencies, 10 per cent	20,500.50
	225,505.50
Channel work between Locks Nos. 4 and 5	40,000.00

SUMMARY.

Finishing Lock No. 4	$169,125.14
Finishing Dam No. 4	32,000.00
Constructing Lock and Dam No. 5	225,505.50
Channel work	52,697.00
Total	479,327.64

Which amount can be economically and profitably expended during the year ending June 30, 1901.

Money statement.

July 1, 1898, balance unexpended		$14,516.15
Amount appropriated by river and harbor act approved March 3, 1899		20,000.00
		34,516.15
June 30, 1899, amount expended during fiscal year		14,512.00
July 1, 1899, balance unexpended		20,004.15
July 1, 1899, outstanding liabilities		3,159.04
July 1, 1899, balance available		16,845.11
Amount (estimated) required for completion of existing project		800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$478,000.00	
For maintenance of improvement	2,000.00	
		480,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 andof sundry civil act of June 4, 1897.		

Appropriations.

August 14, 1876	$30,000	August 11, 1888	$60,000
June 18, 1877	75,000	September 19, 1890	150,000
March 3, 1879	45,000	July 13, 1892	130,000
June 14, 1880	75,000	August 18, 1894	110,000
March 5, 1881	60,000	June 3, 1896	50,000
August 2, 1882	83,700	March 3, 1899	20,000
July 5, 1884	50,000		
August 5, 1886	45,000	Total	983,700

COMMERCIAL STATISTICS.

The following commercial statistics are reported by the White Star Line Steamboat Company and Lathrop Hatton Lumber Company:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—	Passengers.
		Light.	Loaded.			
		Inches.	*Inches.*			
Willie C. Wagnon	151.94	16	48	18	Rome, Gadsden, Greensport and Locks 1, 2, 3 and 4.	310
Resaca	82	16	48	65	.....do	1,750
Connesauga	39.37	11	36	25	.....do	1,000

Freight carried.

Articles.	Quantity.	Tons.
Cotton ... bales	14,000	3,500
Cotton seed ... sacks	16,000	800
Fertilizers ... do	20,000	2,000
Hides and skins ... packages	100	6
Live stock ... head	75	30
Lumber ... feet, B. M.	13,500,000	27,000
Staves	2,000,000	20,000
Provisions ... packages	30,000	1,600
Grain ... sacks	75,000	4,000
Miscellaneous freight ... packages	50,000	8,000
Total		66,936

Estimated value of above freight, in round numbers, $2,000,000.

REMARKS.

The following remarks are quoted from the report of Mr. D. M. Andrews, the assistant engineer in local charge:

The name Coosa has been variously given as meaning big or great water, and beautiful. The Bureau of Ethnology of the Smithsonian Institute gives it as being probably derived from the Choctaw word "Coosha," meaning "reedy." The following derivation of the name is gathered from Pickett's History of Alabama: De Soto, in his wanderings in Alabama, found a powerful tribe of Indians, the Coosas, living along the river banks, who, according to traditions among the Muscogees, were conquered by that tribe at the end of the migration from Mexico and amalgamated with it. The language of the Coosas perished, and their name alone survives, in that of the river.

De Soto discovered the river in 1540 and marched down its entire length. After his discovery the region through which it passes remained undisturbed, except by the tribal wars of the Indians, for nearly a century and a half.

In 1813–14 it became the scene of General Jackson's campaign against the Creek Indians, which practically terminated with the battle of the Horseshoe, upon the Tallapoosa River, March 27, 1814. The above historical facts are gathered from Pickett's History of Alabama.

It is deemed proper to give a brief outline of the geology and more prominent mineralogical aspects of the Coosa Basin, as indicating its resources and agricultural, commercial, and manufacturing possibilities.

The Coosa's tributaries, the Etowah and Coosawatee, have their sources in the mountains of northern Georgia. The Etowah to Cartersville, Ga., and the Coosawatee to Carters, Ga., flow through the older crystalline rocks, whose exact geological horizons are yet undetermined. In this part of the basins of these rivers lie many of the gold mines and marble quarries of northern Georgia, and the manganese, ocher, and iron deposits of Cartersville, Ga.

The Coosa and its tributaries below the points named lie entirely within the formations of the Paleozoic era, down to 6 miles south of the crossing of the Louisville and Nashville Railroad from Calera, Ala., to Gadsden, Ala., and in its course cuts through all the formations of that era. Below the point named the river passes over crystalline rocks belonging to pre-Cambrian formations, until Wetumpka is reached, and there enters the Coastal plain and the Cretaceous formation through which it flows to its junction with the Tallapoosa River.

Lying in the basin of the Coosa River are great deposits of coal, iron ore (both limonite and hematite), bauxite, limestone, roofing slates, and forests of long-leaf (Southern) pine and hard woods of many varieties.

Agriculturally the valleys of the Coosa and its tributaries are very fertile, and are adapted to the cultivation of cotton, corn, wheat, rye, oats, clover, and, indeed, to the cultivation of all the crops of the temperate zone. The adjacent hills are admirably adapted to the cultivation of fruits and grapes.

The drainage area of the Coosa Basin to Riverside, Ala., 113 miles above Wetumpka, including its tributaries, is 6,850 square miles. The discharge at Riverside, Ala., gauge reading 2 feet, is 4,400 second-feet. The number of days the gauge at Riverside read 2 feet and above during the fiscal year ending June 30, 1899, was 329. The fall from Greensport, Ala., to Wetumpka, Ala., that part of the river in which the rapids occur, a distance of 142 miles, is 367 feet. The total number of horsepowers that can be developed from the fall and discharge given is 382,882.

The geological information given in this report was obtained from reports of the Georgia and Alabama State Geological Surveys and from Dr. Eugene A. Smith, State geologist of Alabama; the gaugings, discharge measurements, and much of the geological information from Mr. B. M. Hull, hydrographer, United States Geological Survey, for the States of Georgia, Alabama, etc.

There are no data available from which the horsepowers of the Coosa's tributaries can be determined. They are undoubtedly great, and will in the future play an important part in the industrial development of the country.

2. BETWEEN WETUMPKA AND EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

ORIGINAL CONDITION BEFORE IMPROVEMENT.

The original condition of the part of the Coosa River between the East Tennessee, Virginia and Georgia Railroad Bridge and Wetumpka, Ala., was such as to make navigation entirely impossible. The channel-way was formed of a series of short, deep pools, seldom more than a mile in length, separated from each other by wide shoals, some of which are as much as 12½ miles in length.

There was no navigation on the river, neither had there ever been any, unless floating cotton down the river on flatboats, which never returned, can be called navigation. These flatboats used to go down the river to Mobile at high water. Since the construction of railways which are able to move the cotton crop to different seaports, this part of the river has never been used.

PROJECT.

During the summer and fall of 1889 a hurried survey was made of the part of the Coosa River lying between Lock No. 4 and Wetumpka, Ala. As a result of this survey the following project was prepared:

To construct 27 locks and dams of varying lifts; to have a uniform available length of 280 feet and width of 52 feet, between Lock 4 and Wetumpka, Ala., the last one of the series, No. 31, being at the last-named place. No lift of lock was to exceed 15 feet. In addition to these locks and dams the channel was to be cleared of various rock reefs and points. The depth of water proposed was 4 feet, so far as the channel work was concerned, and 6 feet for the locks. The total estimated cost of the work was $6,074,913.

The river and harbor act of 1890 reduced the length of the proposed locks to 210 feet between hollow quoins and the width to 40 feet.

The project was modified on this basis, and the total cost placed at $6,038,219. The river and harbor act of 1892 restored the dimensions proposed originally for the locks.

The amount expended to the end of the fiscal year ending June 30, 1898, was $374,934.72.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

It remains the same as at the end of the previous fiscal year.

A detailed survey at the proposed sites of Locks Nos. 9 and 10 was made at a cost for field work of $7,285.09.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1899.

No work was done further than the preservation and care of the property belonging to the improvement and completing the maps of the survey for the site for Locks 9 and 10.

There was expended during the year ending June 30, 1899, $3,372.22.

RECOMMENDATIONS AND ESTIMATES.

It is recommended that a detailed survey be made to determine the site for Lock No. 30, the next of the series above Wetumpka, Ala., and that as soon as this point is settled that steps be taken to acquire title to the land that may be needed. When the title to the land has been obtained, it is then recommended that, with the funds in hand, work be commenced in building the railroad from Lock No. 31 to Lock No. 30, to move up the plant and material on hand at Lock No. 31, which it is proposed to utilize, and erect the buildings that will be required for the prosecution of the work in the construction of Lock No. 30; also, to prepare detailed plans for the construction of Locks 9 and 10, as recommended in report of board of engineers for this river. (See Report of Chief of Engineers for 1897, p. 1654.)

It is estimated that the cost of Lock No. 30 will be as follows:

Estimated cost of detailed survey	$1,000.00
10 acres of land, at $50 per acre	500.00
700 lineal feet cofferdam, at $20.30	14,210.00
9,504 cubic yards concrete, at $7	66,528.00
107 cubic yards quoins, at $25	2,675.00
8,060 cubic yards earth excavation, at 78 cents	6,287.00
7,287 cubic yards rock excavation, at $2.39	17,416.00
Lock house	3,000.00
2 miles railroad, from Wetumpka to lock	10,000.00
Fencing, outbuildings, moving machinery, etc., from Wetumpka to Lock 30	5,000.00
	126,616.00
Contingencies, 10 per cent	12,661.60
Total	139,277.60
Care, preservation, and repairs	2,000.00
Preparation of plans	1,300.00
	142,577.60
Deduct balance on hand	31,450.25
	111,127.35

Or, say, $112,000.

Amount (estimated) required for completion of project, $4,683,074.

Money statement.

July 1, 1898, balance unexpended	$35,065.28
June 30, 1899, amount expended during fiscal year	3,372.22
July 1, 1899, balance unexpended	31,693.06
July 1, 1899, outstanding liabilities	242.81
July 1, 1899, balance available	31,450.25
Amount (estimated) required for completion of existing project	4,683,074.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	112,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

September 19, 1890	$150,000
July 13, 1892	100,000
August 18, 1894	110,000
June 3, 1896	50,000
Total	410,000

REMARKS.

The above estimates for work on the Coosa River are based largely on the recommendations of the board of engineers upon the improvement of the Coosa River between Wetumpka and the East Tennessee, Virginia and Georgia Railroad Bridge, published in the Report of the Chief of Engineers for 1897, pages 1650 to 1654. The total estimate, $691,327.60, is less than that estimated by the board, owing to the facts that Lock No. 4 is partially completed and that the dam at Lock No. 30 is not to be constructed at present. I agree entirely with the board that the economical way to improve the river is to work at both ends and in the middle—I am considering the river now as a whole—and my estimates provide for the establishment and maintenance of three lock-building plants. One of these is at Lock 4 and will be used there; one is at Lock 31 and is to be repaired and moved to Lock 30, and a new plant will be required for Lock No. 5.

The object in selecting these locks for work is for easy communication from sources of supply, by rail from Lock 31 to Lock 30, and, as soon as the dams are completed at Lock 5, by boat from Lock 4, to which point navigation now extends. I consider it advisable to postpone the construction of the dam at Lock 30 to avoid backing up water on the sites of the locks above until the improvement at this end extends far enough up to draw commerce for the Alabama River.

On the upper river commerce has followed the improvements downstream as fast as they were made and will doubtless continue to do so.

In addition to the commerce now on the river, stated above to be valued at $1,150,000, I have collected statistics from the main centers of production in the Coosa Valley. They are as follows, values and amounts being for outgoing shipments:

	Anniston, Ala.	Childersburg, Ala.	Rome, Ga.	Center, Ala.	Lincoln, Ala.	Riverside, Ala.	Gadsden, Ala.	Ragland, Ala.	Gaylesville, Ala.	Total.
Cotton.........bales..	70,000	5,000	65,000	3,300	3,500	330	25,000	700	1,100	173,930
Cotton seed....tons..	2,500	1,200	500	110	2,000	100	....	87	100	6,547
Wheat..... bushels..	2,000	....	15,000	2,800	....	....	....	....	......	19,800
Oats............do....	100,000	....	....	2,000	....	....	....	....	......	102,000
Corn............do....	800,000	....	....	4,000	....	6,000	....	....	......	810,000
Miscellaneous agricultural products, dollars.............	50,000	....	....	....	....	....	....	....	......	50,000
Lumber ....tons..	7,500	1,000	8,000	20,000	....	30,000	40,000	....	......	106,500
Cattle ...... dollars..	50,000	5,000	30,000	10,000	12,500	....	16,000	....	......	123,500
Iron ore.......tons..	288,000	....	30,000	5,000	....	....	375,000	....	......	698,000
Cotton cloths.dollars.	300,000	....	2,225,000	....	....	....	1,800,000	....	......	4,325,000
Car works.....do....	2,000,000	....	....	....	....	....	800,000	....	......	2,800,000
Iron furnaces..tons..	144,000	....	25,550	....	....	....	95,000	....	......	264,550
Pipe works....do....	58,000	....	....	....	....	....	15,000	....	......	73,000
Other manufactures, dollars...............	310,000	....	610,000	....	15,000	....	46,000	....	......	981,000
Coal...........tons..	....	....	....	....	....	....	....	40,000	......	40,000
Valuation of manufacturing plant, dollars.............	2,787,500	75,000	2,038,000	....	15,000	....	1,665,000	....	......	6,580,500
Coal consumed.tons..	100,388	....	....	....	....	....	....	....	......	100,388
Coke consumed.do...	22,800	....	....	....	....	....	....	....	......	22,800
Total annual value of trade...dollars..	7,500,000	100,000	4,000,000	750,000	100,000	100,000	1,500,000	65,300	75,000	14,190,300

With the statistics from these different cities and towns I have received statements that their trade would increase 100 to 200 per cent on the opening of the Coosa, that freight rates would fall 50 per cent, and so forth.

While some of these estimates may be oversanguine, I believe that the present value of transportation to and from points in the valley exceeds $20,000,000 annually (I have no figures of incoming shipments); that at least 25 per cent of this amount would be transferred to the river if a water route to the Gulf was secured, and that a vast amount of new traffic would open up in iron ore, coal, and lumber from the rich districts lying idle in the valley. In view of the foregoing facts and the amount of money which has already been spent in improving the Coosa River, I strongly recommend that work be pushed to completion, and that appropriations be made of $600,000 to $800,000 annually for the continuation of the project, which could thus be finished in six or seven years.

R 14.

OPERATING AND CARE OF CANALS AND OTHER WORKS OF NAVIGATION ON COOSA RIVER, GEORGIA AND ALABAMA.

Locks Nos. 1, 2, and 3 were opened to navigation June 30, 1890, and have been operated continuously without interruption to navigation, except during the periods stated below.

In February, 1895, the canal between Locks Nos. 2 and 3 was frozen over for ten days, thus closing the canal to navigation during that period. During the fiscal year ending June 30, 1899, Lock No. 3 was closed to navigation from January to June while a concrete floor 12 inches thick was being laid over the entire bottom of the lock to stop leakage from under the walls. The culvert valves were repaired at the same time.

In February while the lock was closed to navigation the temperature fell to —8½°, the lowest recorded temperature for the locality.

The amount expended to the end of the fiscal year ending June 30, 1898, was $42,978.98.

During the fiscal year ending June 30, 1899, the following expenditures were made:

Locks Nos. 1, 2, and 3.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1898.				
July	1	Sundry persons	Pay roll	$316.00
Do	2	.....do	.....do	150.00
August	1	D. M. Andrews	Traveling expenses	5.30
Do	2	Sundry persons	Pay roll	150.00
Do	3	.....do	.....do	19.00
Do	4	.....do	.....do	23.50
September	1	.....do	.....do	150.00
Do	2	Griffin Bros	Wood	29.37
Do	3	D. M. Andrews	Traveling expenses	5.90
October	1	Sundry persons	Pay roll	150.00
November	1	.....do	.....do	150.00
Do	2	Louisville and Nashville R. R. Co.	Transportation	5.78
Do	3	Southern Railway Co	.....do	2.72
December	1	Sundry persons	Pay roll	150.00
1899.				
January	1	.....do	.....do	1,121.59
Do	2	Ed. C. Fowler Co	Stationery	4.00
Do	3	Terry & Davant	Rubber stamps	2.05
Do	4	Sundry persons	Emergency purchases	127.80
Do	5	.....do	.....do	19.90
Do	6	.....do	Pay roll	5.00
Do	7	.....do	.....do	20.75
Do	8	May & Thomas Hardware Co	Waste and sheet iron	14.25
Do	9	Moore & Handley Hardware Co.	Miscellaneous supplies	59.62
Do	10	Cater Grocery Co	Provisions	20.22
Do	11	Southern Express Co	Transportation of funds	1.92
Do	12	The Chas. Taylor's Sons Co	Fire-clay tiles	11.98
Do	13	Chas. L. Campbell	Services	125.00
Do	14	J. Bundy	.....do	50.00
February	1	Sundry persons	Pay roll	1,227.75
Do	2	.....do	.....do	24.50
Do	3	Cater Grocery Co	Provisions	70.71
Do	4	The Milner & Kettig Co	Flap valves	70.00
Do	5	Montague & Co	Terra-cotta pipe	21.65
Do	6	Ragland Coal Co	Coal	42.17
Do	7	Southern Express Co	Transportation of funds	1.46
Do	8	Chas. L. Campbell	Services	125.00
March	1	Sundry persons	Emergency purchases	17.72
Do	2	.....do	Pay roll	406.05
Do	3	Cater Grocery Co	Provisions	37.01
Do	4	Sundry persons	Emergency purchases	18.45
Do	5	R. H. Gorgas	Services	125.00
April	1	Sundry persons	Pay roll	223.10
Do	2	.....do	.....do	9.87
Do	3	Southern Express Co	Transportation of funds	1.11
Do	4	Chas. L. Campbell	Services	125.00
May	1	Cater Grocery Co	Provisions	45.17
Do	2	Southern Express Co	Transportation of funds	.46
Do	3	Sundry persons	Pay roll	30.00
Do	4	.....do	.....do	323.35
Do	5	.....do	.....do	5.99
Do	6	Cater Grocery Co	Provisions	52.60
June	1	Sundry persons	Pay roll	1,002.72
Do	2	.....do	.....do	8.50
Do	3	Ragland Coal Co	Coal	142.40
Do	4	Sundry persons	Emergency purchases	47.77
Do	5	Henry Hawkins	Stone and sand	20.08
Do	6	E. M. Whiteside	Fresh beef and vegetables	16.41
Do	7	Williamson Iron Co	Valve stem	8.00
				7,141.60

Money statement.

July 1, 1898, balance unexpended	$673.02
Amount appropriated by river and harbor act approved March 3, 1899	6,819.21
	7,492.23
June 30, 1899, amount expended during fiscal year	7,141.60
July 1, 1899, balance unexpended	350.63
July 1, 1899, outstanding liabilities	329.31
July 1, 1899, balance available	21.32

APPENDIX S.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI, AND OF BOGUE CHITTO, LOUISIANA.

REPORT OF MAJOR WM. T. ROSSELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mobile Harbor, Alabama.
2. Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek.
3. Operating and care of locks and dams on Black Warrior River, Alabama.
4. Warrior and Tombigbee rivers, Alabama and Mississippi.
5. Noxubee River, Mississippi.
6. Pascagoula River, Mississippi.
7. Pascagoula River and Horn Island Harbor, Mississippi.
8. Chickasahay River, Mississippi.
9. Leaf River, Mississippi.
10. Channel from Gulfport to Ship Island Harbor, Mississippi.
11. Ship Island Pass, Mississippi.
12. Mouth of Pearl River, Mississippi.
13. Pearl River below Jackson, Mississippi.
14. Pearl River between Carthage and Jackson, Mississippi.
15. Pearl River between Edinburg and Carthage, Mississippi.
16. Bogue Chitto, Louisiana.
17. Survey for canal between Warrior River and Five-Mile Creek, Alabama.
18. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEYS.

19. Horn Island Pass and Harbor, Mississippi.
20. Channel through Ship Island Pass, and from Ship Island to Gulfport and to Biloxi, Mississippi.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., July 20, 1899.

GENERAL: I have the honor to forward herewith annual report * * * for the fiscal year ending June 30, 1899, for the works of rivers and harbors under my charge.

* * * * * * *

Very respectfully, your obedient servant,

WM. T. ROSSELL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

S 1.

IMPROVEMENT OF HARBOR AT MOBILE, ALABAMA.

ORIGINAL CONDITION OF WORK.

For original condition of this work, see pages 1425 and 1426, Annual Report of 1896.

For maps of Mobile Bay from 1764 to 1820, see page 1432, Annual Report of 1896.

PLAN OF IMPROVEMENT.

The present plan is to continue the improvement with a view of ultimately securing a channel 23 feet deep and 100 feet wide at the bottom, with appropriate slope.

WORK PRIOR TO JUNE 30, 1898.

For work prior to June 30, 1898, see pages 1426, 1427, and 1428, Annual Report for 1898.

WORK OF THE PAST YEAR.

On July 1, 1898, an appropriation of $30,000 was made for the maintenance of the channel in Mobile Harbor by dredging. Invitations of proposals for hire of dredging plant were advertised on July 25, 1898, and bids opened August 24, 1898, and rejected, price being considered too high. Invitations were renewed on September 14, 1898, and bids opened October 13, 1898, and also rejected, price being considered excessive.

A contract for the hire of a dredging plant was finally entered into on December 12, 1898, with the National Dredging Company, of Wilmington, Del., on the same terms and conditions governing their contracts dated December 28, 1896, and February 26, 1898, the contractor guaranteeing a daily removal of 2,875 cubic yards at the rate of $230 per day of eight hours, furnishing a dredging plant consisting of the dredge *Chas. Fobes*, steam tug *Mary B. Curtis*, three scows, and the coal sloop *Captain Ben*.

From December 22, 1898, to May 9, 1899, the contractor removed 315,000 cubic yards of material in one hundred and eight days seven hours and fourteen minutes, being a daily average of 2,892.45 cubic yards. In addition to the above, seven days and forty-six minutes were lost owing to stormy weather and are subject to supplemental contract. The dredge progressed as follows: On a double cut of 80 feet width, 712 feet, or from 600 feet south of Station 50 to 1,312 feet south of said station; on a single cut of 40 feet width, 25,168 feet, or from 1,312 feet south of Station 50 to 80 feet south of Station 60; giving, for a distance of 25,880 feet, a depth of 20 feet at mean low water, where the channel had shoaled considerably.

A plan and project for dredging a channel from Chickasabogue Creek to the 23-foot curve in Lower Mobile Bay, giving a bottom width of 100 feet, with appropriate side slope, was forwarded to Congress and published as House Doc. No. 199, Fifty-fourth Congress, first session.

By the river and harbor act approved March 3, 1899, the sum of $100,000 was appropriated and authority granted to enter into contract in the sum of $500,000 in addition thereto. The words of the law are as follows:

> Improving Harbor at Mobile, Alabama: Continuing improvement, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary with the view of

ultimately securing a channel twenty-three feet deep and one hundred feet wide at the bottom, with appropriate slope, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate five hundred thousand dollars, exclusive of the amount herein and heretofore appropriated.

Here the improvement of Mobile Harbor enters on its fifth stage.

In conformity with the above conditional appropriation, proposals for dredging were advertised on April 12, 1899, and bids opened on May 12, 1899. The contract was awarded to the National Dredging Company, of Wilmington, Del., at 7 cents per cubic yard, on May 18, 1899, and the work entered upon June 26, 1899, commencing at a point 471 feet south of Station 40, on a double cut of 80 feet width, with a clamshell dredge, a steam tug, two scows, and a coal sloop. The easterly cut of 40 feet width, 400 feet westerly to a line passing through Stations J and L, was advanced southerly 1,520 feet south of the initial point; and the westerly cut of 40 feet width, 440 feet westerly from Stations J and L, was advanced southerly 1,208 feet, the plant removing 46,710 cubic yards of material, soft grayish clay and little ooze, in five working days, leaving a depth of between 24.5 and 25.5 feet at mean low water within the excavated area.

During the past year the U. S. steamer *Maud* has removed all deadheads found in the channel.

Two maps are inclosed herewith, showing present condition of dredged channel.

The total amount expended on this improvement to June 30, 1899, is $2,271,108.41, of which $2,308.41 was expended on the project adopted in 1899.

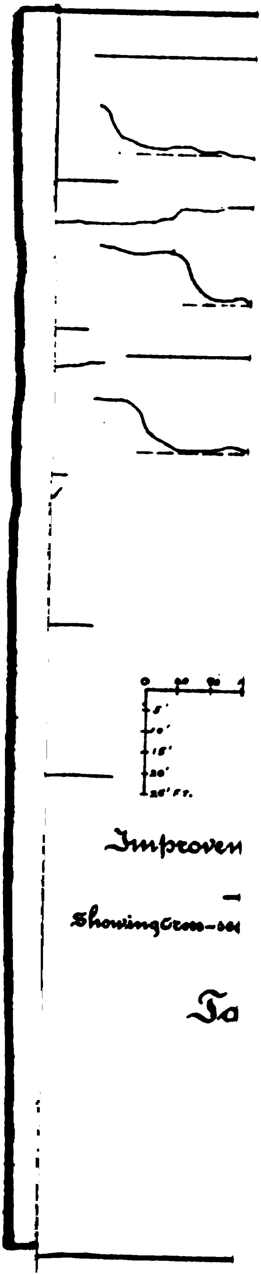
Tabular statement showing the channel as dredged and its condition on June 30, 1899.

Locality.	Dredged.		Examinations.							
						Maximum depth in cross section.				
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	June, 1891.	June 1896.	June, 1897.	June, 1898.	June 1899.
	Feet.	*Feet.*		*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station 0	......	......	Initial point at mouth of Chickasabogue Creek.	......	1,550	15.9	15.6	15.7	15.3	15.8
			South of initial point.							
Station 0 to 1	......	......	0.50 mile	2,640	950	28.0	24.5	27.1	26.8	27.5
Station 1 to 2	......	......	1.00 mile	2,640	750	21.3	24.3	26.7	24.5	24.0
Station 2 to 3	......	......	1.50 miles	2,640	800	21.3	27.8	26.2	27.1	25.5
Station 3 to 4	120	23-24	2.00 miles	2,640	1,060	18.9	25.1	26.0	26.1	25.2
Station 4 to A	120	23-24	2.03 miles	200	1,070	18.9	24.8	24.2	24.8	23.3
Station A to 5	120	23-24	2.50 miles	2,440	960	21.3	24.4	25.7	25.5	26.3
Station 5 to 6	120	23-24	3.00 miles	2,640	1,085	16.7	24.2	23.4	22.9	22.5
Station 6 to 7	160	23-24	3.50 miles	2,640	910	16.5	23.4	23.1	23.1	23.2
Station 7 to B	80	23-24	3.54 miles	240	890	17.1	23.4	23.3	23.2	23.1
Station B to 8	80	23-24	4.00 miles	2,400	720	16.4	22.8	22.7	21.8	21.4
Station 8 to C	80	23-24	4.21 miles	1,210	700	19.7	23.5	23.7	23.5	23.2
Station C to 9	80	23-24	4.50 miles	1,430	570+	21.3	27.7	25.8	25.1	26.5
Station 9 to 10	240	23-24	5.00 miles	2,640	700	19.7	27.8	25.3	25.2	24.1
Station 10 to D	240	23-24	5.04 miles	245	700	17.6	26.5	25.9	25.7	23.1
Station D to E	475	23-24	5.35 miles	1,650	700	19.6	27.0	25.8	24.1	23.9
Station E to 11	475	23-24	5.50 miles	745	700	19.9	26.1	25.7	25.4	25.1
Station 11 to F	475	23-24	5.54 miles	233	700	19.9	26.9	25.6	24.8	24.3
Station F to 12	280	23-24	6.00 miles	2,407	700	21.3	24.8	24.5	23.8	24.5
Station 12 to G	280	23-24	6.38 miles	2,034	700	18.3	27.9	26.4	26.4	25.2
Station G to 13	280	23-24	6.50 miles	606	700	18.8	27.2	25.3	25.2	24.9
Station 13 to 14	280	23-24	7.00 miles	2,640	700	24.5	24.1	23.4	22.5	23.1
Station 14 to 15	280	23-24	7.50 miles	2,640	700+	24.5	24.1	22.4	21.8	22.1
Station 15 to 16	280	23-24	8.00 miles	2,640	700+	26.3	25.1	22.7	21.0	20.8
Station 16 to H	280	23-24	8.07 miles	404	700+	26.3	24.5	22.1	21.1	20.8

Tabular statement showing the channel as dredged and its condition on June 30, 1899—Continued.

Locality.	Dredged.		Examinations.							
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	Maximum depth in cross section.				
						June, 1891.	June, 1896.	June, 1897.	June, 1898.	June, 1899.
			South of initial point—Cont'd.							
	Feet.	*Feet.*		*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station H to I	340	23–24	8.49 miles	2,228	700+	24.8	25.0	22.5	21.0	20.9
Station I to 17	340	23–24	8.50 miles	8	700+	24.8	25.0	22.5	21.2	20.8
Station 17 to 18	280	23–24	9.00 miles	2,640	700+	21.8	25.2	21.8	21.9	20.7
Station 18 to 19	280	23–24	9.50 miles	2,640	700+	25.0	27.9	22.5	21.2	20.6
Station 19 to 20	280	23–24	10.00 miles	2,640	700+	26.3	25.2	22.6	21.4	20.8
Station 20 to 21	280	23–24	10.50 miles	2,640	700+	16.9	27.6	22.6	22.0	20.7
Station 21 to 22	280	23–24	11.00 miles	2,640	700+	16.7	24.6	21.9	21.2	20.4
Station 22 to 23	280	23–24	11.50 miles	2,640	700+	16.1	23.0	21.1	21.1	21.3
Station 23 to 24	280	23–24	12.00 miles	2,640	700+	16.5	23.0	20.8	20.6	20.7
Station 24 to 25	280	23–24	12.50 miles	2,640	700+	16.4	24.9	21.4	21.5	20.8
Station 25 to 26	280	23–24	13.00 miles	2,640	700+	16.4	23.9	20.8	21.1	20.7
Station 26 to 27	280	23–24	13.50 miles	2,640	700+	16.2	24.3	21.6	20.8	20.6
Station 27 to 28	280	23–24	14.00 miles	2,640	700+	17.9	25.8	21.6	20.2	20.7
Station 28 to 29	280	23–24	14.50 miles	2,640	700+	16.1	25.3	20.6	20.9	19.8
Station 29 to 30	280	23–24	15.00 miles	2,640	700+	16.2	24.5	21.6	20.7	19.8
Station 30 to 31	280	23–24	15.50 miles	2,640	700+	16.3	22.8	27.5	21.8	19.8
Station 31 to 32	280	23–24	16.00 miles	2,640	700+	16.5	22.9	28.8	22.8	20.4
Station 32 to 33	280	23–24	16.50 miles	2,640	700+	16.1	23.2	26.9	24.2	20.5
Station 33 to 34	280	23–24	17.00 miles	2,640	700+	16.1	23.0	27.7	23.0	21.0
Station 34 to 35	280	23–24	17.50 miles	2,640	700+	15.5	23.0	27.0	25.2	20.7
Station 35 to 36	280	23–24	18.00 miles	2,640	700+	15.7	23.4	27.6	23.1	20.7
Station 36 to 37	280	23–24	18.50 miles	2,640	700+	15.4	24.3	19.5	24.0	20.6
Station 37 to 38	280	23–24	19.00 miles	2,640	700+	15.5	23.5	20.1	23.2	20.3
Station 38 to 39	280	23–24	19.50 miles	2,640	700+	15.3	24.5	20.0	24.2	20.5
Station 39 to 40	280	23–24	20.00 miles	2,640	700+	15.4	24.5	20.4	20.5	20.3
Station 40 to J	280	23–24	20.47 miles	2,471	700+	15.0	24.0	21.0	20.8	18.9
Station J to 41	500	23–24	20.50 miles	169	700+	15.0	23.2	22.0	20.0	18.6
Station 41 to K	500	23–24	20.63 miles	671	700+	15.0	23.0	22.8	19.4	18.6
Station K to L	500	23–24	20.80 miles	918	700+	14.6	22.4	22.2	19.7	18.6
Station L to 42	280	23–24	21.00 miles	1,051	700+	14.6	25.6	25.0	20.9	18.6
Station 42 to 43	280	23–24	21.50 miles	2,640	700+	14.7	26.0	23.0	21.9	19.8
Station 43 to 44	280	23–24	22.00 miles	2,640	700+	14.3	26.0	21.9	21.4	19.6
Station 44 to 45	280	23–24	22.50 miles	2,640	700+	18.4	25.6	20.8	20.5	19.0
Station 45 to 46	280	23–24	23.00 miles	2,640	700+	22.0	27.4	20.7	19.7	19.0
Station 46 to 47	280	23–24	23.50 miles	2,640	700+	22.8	24.6	20.0	25.8	19.1
Station 47 to 48	280	23–24	24.00 miles	2,640	700+	21.5	27.6	19.5	23.3	21.4
Station 48 to 49	280	23–24	24.50 miles	2,640	700+	21.6	25.8	19.5	23.7	20.6
Station 49 to 50	280	23–24	25.00 miles	2,640	700+	21.5	23.9	19.5	25.2	20.1
Station 50 to 51	280	23–24	25.50 miles	2,640	700+	19.0	24.8	19.4	18.9	20.2
Station 51 to 52	280	23–24	26.00 miles	2,640	700+	18.0	26.0	20.0	19.1	19.9
Station 52 to 53	280	23–24	26.50 miles	2,640	700+	13.0	26.4	19.7	18.6	19.8
Station 53 to 54	280	23–24	27.00 miles	2,640	700+	18.2	23.6	19.7	19.0	20.3
Station 54 to 55	280	23–24	27.50 miles	2,640	700+	13.7	26.7	19.8	18.3	20.5
Station 55 to 56	280	23–24	28.00 miles	2,640	700+	13.7	25.3	20.3	18.0	21.5
Station 56 to 57	280	23–24	28.50 miles	2,640	700+	14.4	23.6	20.3	19.5	20.2
Station 57 to 58	280	23–24	29.00 miles	2,640	700+	14.4	21.9	20.7	19.4	21.0
Station 58 to 59	280	23–24	29.50 miles	2,640	700+	14.4	21.3	22.4	19.8	21.7
Station 59 to 60	280	23–24	30.00 miles	2,640	700+	15.3	21.6	23.0	21.2	23.6
Station 60 to 61	280	23–24	30.50 miles	2,640	700+	16.1	21.3	23.1	20.4	19.9
Station 61 to M	280	23–24	30.81 miles	1,659	700+	16.1	21.4	23.1	20.7	20.1
Station M to 63	200	23–24	31.00 miles	981	700+	16.2	22.9	23.2	20.6	20.1
Station 62 to 63	200	23–24	31.50 miles	2,640	700+	23.2	23.9	26.2	21.9	20.8
Station 63 to 64	200	23–24	32.00 miles	2,640	700+	22.3	27.9	24.9	24.1	22.7
Station 64 to 65	200	23–24	32.50 miles	2,640	350	21.0	29.4	28.6	28.8	26.3
Station 65 to 66	200	23–24	33.00 miles	2,640	370	22.9	26.8	26.8	25.2	25.2
Station 66 to N	200	23–24	33.08 miles	459	390	23.1	25.9	25.8	25.8	24.6

	Miles.
Less than 23 feet at mean low water	25¼
Less than 22 feet at mean low water	23¼
Less than 21 feet at mean low water	20
Less than 20 feet at mean low water	7



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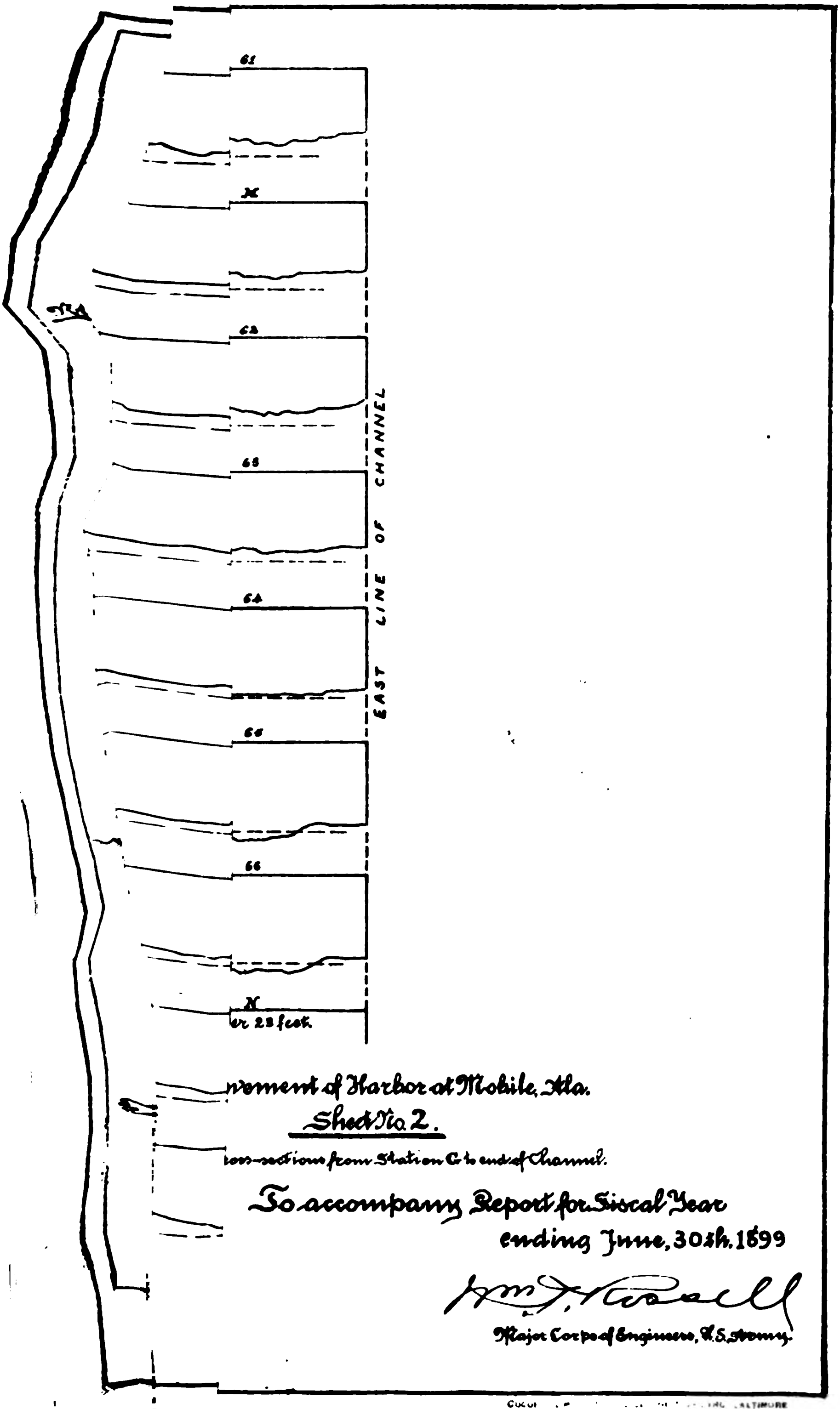

vement of Harbor at Mobile, Ala.

Sheet No. 2.

oss-sections from Station G to end of Channel.

To accompany Report for Fiscal Year
ending June, 30th. 1899

Wm. T. Rossell
Major Corps of Engineers, U.S. Army.

Money statement.

July 1, 1898, balance unexpended		$939.30
Amount appropriated by sundry civil act approved July 1, 1898		30,000.00
Amount appropriated by river and harbor act approved March 3, 1899		100,000.00
		130,939.30
June 30, 1899, amount expended during fiscal year		33,247.71
July 1, 1899, balance unexpended		97,691.59
July 1, 1899, outstanding liabilities	$3,523.64	
July 1, 1899, amount covered by uncompleted contracts	86,730.30	
		90,253.94
July 1, 1899, balance available		7,437.65
Amount (estimated) required for completion of existing project		1,540,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$500,000.00	
For maintenance of improvement	60,000.00	
		560,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Work was first done on the channel leading to the wharves at Mobile by the General Government in 1827.

The following appropriations were made by Congress:

May 20, 1826	$10,000.00
March 2, 1829	20,000.00
June 24, 1834	10,000.00
March 3, 1835	17,997.60
March 3, 1837	50,000.00
July 7, 1838	50,000.00
August 3, 1852	50,000.00
	207,997.60
March 3, 1857 (relief claim)	20,833.08
Total	228,830.68

The second stage of improvement was entered upon in 1870. This project was finished in 1876, under the following appropriations:

By act of Congress—	
July 11, 1870	$50,000
March 3, 1871	50,000
June 10, 1872	75,000
March 3, 1873	100,000
June 23, 1874	100,000
March 3, 1875	26,000
Total	401,000

In the third stage of improvement work was done under appropriations as follows:

June 18, 1878 (survey)	$10,000
March 3, 1879	100,000
June 14, 1880	125,000
March 3, 1881	100,000
August 2, 1882	125,000
July 5, 1884	200,000
August 6, 1886	90,000
Total	750,000

The fourth stage of this work was begun in 1888 and has been completed.

Appropriations have been made as follows:

By act of Congress—	
August 11, 1888	$250,000
September 19, 1890	350,000
July 13, 1892	212,500
Sundry civil act, March 3, 1893	500,000
Sundry civil act, August 18, 1894	390,000
Sundry civil act, March 2, 1895	291,300
March 16, 1896	160,000
June 3, 1896	60,000
June 4, 1897	25,000
Total	2,268,800

The fifth stage of this work was begun in June, 1899, and is now in progress.

The following appropriation has been made:

By act of Congress, March 3, 1899	$100,000

And providing that a contract or contracts might be entered into by the Secretary of War for the expenditure of $500,000 additional.

Abstract of proposals for hire of dredging plant for Mobile River and Bay, Alabama, opened August 24, 1898.

No.	Name and address of bidder.	Hire of dredging plant per day.	To remove each day of 8 hours.	
			Above Station 24.	Below Station 24.
			Cubic yards.	*Cubic yds.*
[a] 1	National Dredging Co., Wilmington, Del	$260.00	300 to 1,200	2,875
[b] 2	Stewart Contracting Co., Columbia, S. C	[c] 115.00 [c] 120.00	500	500

[a] Above Station 24, 34⅔ cents per cubic yard; below Station 24, 9$\frac{1}{25}$ cents per cubic yard; average price about 14⅓ cents per cubic yard.

[b] Above Station 24, 23 cents per cubic yard; below Station 24, 23 cents per cubic yard.

[c] According to size of tug used.

Abstract of proposal for hire of dredging plant for Mobile River and Bay, Alabama, opened October 13, 1898.

No.	Name and address of bidder.	Hire of dredging plant per day.	To remove each day of 8 hours.	
			Above Station 24.	Below Station 24.
			Cubic yards.	*Cubic yds.*
1	National Dredging Co., Wilmington, Del	$260	300 to 1,200	2,875

On recommendation of the Chief of Engineers, United States Army, dated November 5, 1898, authority was granted by the Secretary of War on November 29, 1898, to enter into a contract with the National Dredging Company, of Wilmington, Del., for the hiring of a dredging plant at $230 per day of eight hours. The terms and conditions of this contract, which was dated December 12, 1898, were the same as in previous contracts, dated December 28, 1896, and February 26, 1898.

Abstract of proposals for dredging in Mobile Harbor, Alabama, opened May 12, 1899.

No.	Name and address of bidder.	Number of dredges.	Number of scows.	Number of tugs.	Price per cubic yard. Cts.	Time of commencing work.	Time of completion of work.
1	National Dredging Co., Wilmington, Del.	3	9	4	[a]7	In accordance with specifications.	In accordance with specifications.
2	Rittenhouse Moore Dredging Co., Mobile, Ala.	2	(b)	[c]2	7.3	......do	Do.

[a] Recommended for approval.
[b] As many as may be necessary.
[c] And as many more as may be necessary.

CONTRACTS IN FORCE.

With the National Dredging Company, dated May 18, 1899, approved by the Chief of Engineers June 5, 1899, for Dredging in Mobile Bay, Alabama, at the rate of 7 cents per cubic yard. Work commenced June 26, 1899; continuing contract; work for which funds are now available to be completed by June 30, 1900.

COMMERCIAL STATISTICS.

[Compiled from the records of the Mobile Cotton Exchange.]

Articles.	1899.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Lumber	123,098	76,079	106,095	88,045
Timber	164,232	97,765	191,772	129,021
Shingles	87	107	299	185
Staves	3,530	2,323	167	....
Cotton	65,647	86,550	76,847	52,090

Statistics furnished by the United States custom-house, Mobile, Ala.

Description.	Entered.		Cleared.	
	Number.	Tons.	Number.	Tons.
Foreign vessels	478	363,846	491	385,294
Domestic vessels	57	20,294	64	18,231
Total	535	384,140	555	403,525

Value of exports.

Domestic	$8,894,368
Foreign	7,695
Total	8,902,063

Receipts from all sources.

Duties on imports	$11,955.11
Tonnage tax	14,622.24
Fines, penalties, and forfeitures	1,085.00
Miscellaneous customs receipts	1,057.50
Storage and overtime	305.85
Official fees	2,109.97
Total	31,135.67

Comparative statement of the number and draft of vessels passing up and down the dredged channel, compiled from the books of the Mobile harbor master.

Draft, in feet.	Steamships.				Square-rigged vessels.				Schooners.				Total.			
	Up.		Down.		Up.		Down.		Up.		Down.		Up.		Down.	
	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.	1899.	1898.
Less than 13	230	206	112	126	67	54	.....	3	162	40	80	22	459	300	192	151
13 to 14	67	41	55	31	38	28	1	1	1	.....	28	7	106	69	84	39
14 to 15	26	29	55	27	20	17	5	13	.....	.....	34	5	46	46	84	45
15 to 16	10	14	21	28	14	10	9	4	1	.....	13	.....	25	24	43	32
16 to 17	7	12	20	24	2	1	4	3	1	.....	6	.....	10	13	30	27
17 to 18	1	3	15	10	2	1	7	9	.....	.....	3	.....	3	4	25	19
18 to 19	2	1	14	7	.....	.....	12	9	.....	.....	1	.....	2	1	27	16
19 to 20	2	.....	9	13	.....	1	18	10	.....	.....	.....	.....	2	1	27	23
20 to 21	1	.....	14	14	1	.....	16	19	.....	.....	.....	.....	2	.....	30	33
21 to 22	.....	1	15	10	.....	.....	38	15	.....	.....	.....	.....	.....	1	53	25
22 to 23	.....	.....	16	14	.....	.....	27	21	.....	.....	.....	.....	.....	.....	43	35
23 and over	.....	.....	.....	8	.....	.....	.....	10	.....	.....	.....	.....	.....	.....	.....	18
Total	346	307	346	307	144	112	137	117	165	40	155	34	655	459	638	458

S 2.

IMPROVEMENT OF BLACK WARRIOR RIVER, ALABAMA, FROM TUSCALOOSA TO DANIELS CREEK.

For original condition of work and work done prior to June 30, 1898, see pages 1430 and 1431, Annual Report for 1898.

PLAN OF IMPROVEMENT.

To obtain a waterway for transportation of coal in barges from the Warrior coal fields to the Gulf of Mexico by a slackwater system to be obtained by construction of five locks and dams between Tuscaloosa and Daniels Creek, a distance of 13½ miles.

WORK OF THE PAST YEAR.

Act of Congress approved March 3, 1899, provides:

> Improving Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek: Continuing improvement, fifty thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such material and work as may be necessary to construct Lock and Dam Numbered Four, above Tuscaloosa, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred and forty thousand five hundred dollars, exclusive of the amount herein and heretofore appropriated.

On May 22, 1899, a party was organized, with a transitman in charge, and began a contour survey of the site for Lock No. 4. They established on the ground the location of the various structures, made cross sections of required excavation, and made complete borings to bed rock with jet drill under the proposed lock walls, dam, and abutment. This work was finished and party disbanded June 3, 1899. Since then a general map of the site, showing location of structures, also a plan and profiles of borings, and profiles of cross sections have been prepared.

The gauge at Lock No. 4 has been read daily at 7 a. m., floating plant and other property cared for, and a general plan and complete specifications for Lock and Dam No. 4 have been prepared.

The total amount expended on this improvement to June 30, 1899, is $602,125.32.

Money statement.

July 1, 1898, balance unexpended	$3,493.35
Amount appropriated by river and harbor act approved March 3, 1899	50,000.00
	53,493.35
June 30, 1899, amount expended during fiscal year	1,868.67
July 1, 1899, balance unexpended	51,624.68
July 1, 1899, outstanding liabilities	78.50
July 1, 1899, balance available	51,546.18
Amount (estimated) required for completion of existing project	140,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	140,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—	
July 5, 1884	$50,000
August 1, 1886	56,250
August 11, 1888	100,000
September 19, 1890	150,000
July 13, 1892	200,000
August 18, 1894	37,500
June 3, 1896	10,000
March 3, 1899	50,000
Total	653,750

COMMERCIAL STATISTICS.

In addition to the commerce reported elsewhere as passing through the locks, the following commerce on Pool No. 3 stopped at Whites Landing above the locks:

	Tons.
Coal	4,760
Logs	4,960
Total	9,720

S 3.

OPERATING AND CARE OF LOCKS AND DAMS ON BLACK WARRIOR RIVER, ALABAMA.

The three locks were operated and cared for by two lock hands at each lock, under the general supervision of the lock master, without interruption during the year.

During July and August, 1898, the new fence at Lock No. 1, inclosing United States land, was finished, and a similar fence built at Lock No. 3. Land at Lock No. 2 has not been fenced yet, because additional land is needed at this site, negotiations for which have not been concluded. During September, 1898, chamber of Lock No. 1 was cleaned of accumulated mud and spalls. During October and November, 1898, the downstream face of Dam No. 3, which had been injured by saw logs in the "backlash" during the previous winter, was repaired. Several heavy face stones secured by dowels had been torn out during floods. These were replaced and doweled again. During November, 1898, the needle dams were erected at upper end of Locks Nos. 2 and 3, and the upper valves overhauled.

On March 9 to 11, 1899, Lock No. 1 was disabled by mud and brush deposited under the lower gates during high water, making it impossible to operate them. Finally, after delaying the steamer *Ottawa* forty-four hours and the steamer *Baltimore* twenty hours, the obstructions were cleared away and traffic resumed at 3.30 p. m., March 11. The greatest flood since April, 1892, occurred during March, 1899, culminating on the 17th at 61 feet on the Tuscaloosa gauge, 2.2 feet below the highest flood on record. The flood carried immense quantity of drift, but did no damage to the locks or dams, except the usual deposits left by every flood about the gates. As a result of this flood, Lock No. 1 was again disabled April 12 to 14, 1899, by mud deposits 6 feet thick on the lower miter sill. The mud was cleared away by noon of the 14th, no traffic of importance being delayed.

The three dams suffered practically no injury from drift during the past winter, but are leaking badly again, necessitating considerable filling above the dams during the coming low-water season, and this filling will probably be an annual charge.

On May 5, 1899, a bad leak was discovered under the lower miter sill at Lock No. 1. Examinations by diver indicated that the sill had been forced up about 2½ inches at the miter joint, and the concrete backing crushed in places. Temporary repairs were made on May 11, 1899, with neat cement in bags, traffic being suspended six days to give the cement time to harden. The repairs were successful, and there has been no further movement of the sills, the lock being kept empty except when lockages are made. Materials have been assembled and preparations made to repair the sills and repaint the gates at the same time the new valves are put in. All of the work enumerated above was done by the regular lock hands, aided at certain times by a few extra laborers.

In February, 1899, a machinist, with a few helpers and the regular lock hands, began building six new steel balanced gate valves, to take the place of the six curtain valves at Lock No. 1. There was considerable delay, waiting for certain parts ordered from the New Jersey Steel and Iron Company, but the work continued at intervals until the six valves were finished ready for erection on June 29. The public have been notified that Lock No. 1 will be closed to navigation on July 3, 1899, when it is proposed to begin putting in the new valves. The old curtain valves are slow in operation and have proved very costly for repairs. They were put in during the fall of 1894, and have been practically rebuilt twice since. We have not been able to find a flexible water-tight material that would stand the strains of frequent opening against the head of water for more than two years without wearing out. During June, 1899, the upper end of chamber of Lock No. 1 was again cleared of deposit, the mud being hoisted with the derrick boat and dumped above the dam for filling.

Detailed statement of expenditures during fiscal year ending June 30, 1899.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1898.				
August	1	Sundry persons	Pay roll	$399.00
	2	Woolsey Finnell	Mule hire	3.25
	3	J. Snow Hardware Co	Lumber	65.48
	4	Tuscaloosa Telephone Exchange	Maintenance of telephone	4.00
	5	Allen & Jemison Co	Lumber	108.01
September	1	Sundry persons	Pay roll	389.89
	2	Tuscaloosa Telephone Exchange	Maintenance, etc	4.00
October	1	Sundry persons	Pay roll	417.15
	2	Tuscaloosa Telephone Exchange	Maintenance	4.00
	3	John T. Cochrane	Oil	5.71
	4	J. S. Christian	Coal	9.45
November	1	Allen & Jemison Co	Hardware	.98
	2	Sundry persons	Pay roll	305.00
	3	J. S. Christian	Coal	1.60

Detailed statement of expenditures during fiscal year ending June 30, 1899—Continued.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1898.				
December	1	Sundry persons	Pay roll	$302.83
	2	J. Snow Hardware Co	Hardware	.50
1899.				
January	1	Sundry persons	Pay roll	305.00
	2	Tuscaloosa Telephone Exchange	Maintenance, etc	12.00
	3	J. Snow Hardware Co	Hardware	.50
	4	John T. Cochrane	Oil	5.54
February	1	Sundry persons	Pay roll	852.00
March	1	do	do	434.00
	2	Allen & Jemison Co	Hardware	.75
	3	The Lane & Bodly Co	Castings	23.00
	4	John T. Cochrane	Oil	5.54
April	1	Sundry persons	Pay roll	449.00
	2	Tuscaloosa Belt Rwy. Co	Transportation	3.25
	3	F. G. Blair	Coal	8.75
	4	Tuscaloosa Telephone Exchange	Maintenance, etc	12.00
	5	Edward Smith & Co	Paint	8.00
	6	D. C. Cox	Hire of team	3.75
	7	Allen & Jemison Co	Hardware	5.65
May	1	Sundry persons	Pay roll	463.25
	2	Revere Rubber Co	Rubber	87.50
June	1	Sundry persons	Pay roll	340.62
	2	Western Union Telegraph Co	Telegram	.21
	3	Friedman & Rosenau	Duck cloth	22.83
	4	R. E. Rodes	Coal and lumber	70.32
	5	Allen & Jemison Co	Metal coating and cement	239.26
	6	J. Snow Hardware Co	Thread	1.05
	7	Tuscaloosa Belt Rwy. Co	Hauling, etc	5.50
	8	Hardie-Tynes Foundry and Machine Co.	Valve castings	91.86
	9	New Jersey Steel and Iron Co	Steel plates, etc	506.94
		Total		5,428.92

The following is a statement of expenditures for operating and care of canals, Black Warrior River, Alabama, during fiscal year ending June 30, 1899, submitted in accordance with circular No. 12, from office of the Chief of Engineers, United States Army, dated Washington, D. C., July 31, 1897:

Items.	Allotted.	Expended.	Balance.	Minus balance.
Salaries, lock hands	$3,660.00	$3,352.83	$307.17	
Riprap bank protection	200.00		200.00	
Filling above dams	300.00		300.00	
Fuel, lights, and oil	100.00	44.14	55.86	
Tools	100.00	.55	99.45	
Repairs to gates and valves	750.00	940.77		$190.77
Telephone service (maintenance)	48.00	36.00	12.00	
Fencing locks 1, 2, and 3	650.00	324.40	325.60	
Incidentals	500.00	135.60	364.40	
Removing flood deposit		90.73		90.73
Cofferdams		90.40		90.40
Repairs, miter sills		178.74		178.74
Painting gates and valves		146.26		146.26
Repairs to dams		88.50		88.50
Total	6,308.00	5,428.92	1,664.48	785.40

Money statement.

July 1, 1898, balance unexpended	$2,041.99
Amount allotted during fiscal year	4,266.01
	6,308.00
June 30, 1899, amount expended during fiscal year	5,428.92
July 1, 1899, balance unexpended	879.08
July 1, 1899, outstanding liabilities	674.01
July 1, 1899, balance available	205.07

COMMERCIAL STATISTICS.

Traffic.

Vessels, etc.	Lock No. 1.			Lock No. 2.			Lock No. 3.		
	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.
Towboats	85	85	170	149	146	295	154	154	308
Government boats	1	1	2	1	1	2	....	....	....
Coal barges	44	41	85	51	47	98	52	51	103
Other barges	12	14	26	21	20	41	22	20	42
Government barges	1	6	7	4	4	8	8	3	6
Government small craft	2	7	9	23	22	45	16	16	32
Small craft	27	26	53	20	19	39	24	31	55
Rafts	9	3	12	11	5	16	11	4	15
Total	181	183	364	280	264	544	282	279	561
Passengers	204	144	348	385	336	721	379	353	732
Lockages	106	114	220	175	179	354	180	192	372

Commerce.

[In tons.]

Lock.	Date.	Coal.	Cement.	Logs.	Lumber.	Cedar posts.	Bridge irons.	General and miscellaneous.	Total.
No. 1	July, 1898	65	....	14	31	....	....	1.75	111.75
	August, 1898	100	....	23	151	....	....	23.75	297.75
	September, 1898	220	....	14	....	....	....	2.25	236.25
	October, 1898	60	....	....	....	....	....	.75	60.75
	November, 1898	135	....	19	....	....	....	1.75	155.75
	December, 1898	125	....	71	....	....	....	1.25	197.25
	January, 1899	....	....	120	....	....	....	.25	120.25
	February, 1899	....	....	....	....	....	....	....	....
	March, 1899	168	....	....	....	....	....	.50	168.50
	April, 1899	44	....	81	....	....	....	10.75	135.75
	May, 1899	40	66	....	....	....	....	6.50	112.50
	June, 1899	102	22	....	....	....	35	6	165
	Total	1,059	88	342	182	....	35	55.50	1,761.50
No. 2	July, 1898	65	....	14	195	....	....	7.25	281.25
	August, 1898	100	....	23	151	....	....	27.50	301.50
	September, 1898	220	....	24	....	10	....	4.50	258.50
	October, 1898	60	....	....	....	....	....	1.75	61.75
	November, 1898	135	....	19	....	....	....	2.25	156.25
	December, 1898	125	....	120	....	....	....	1.75	246.75
	January, 1899	....	....	101	....	....	....	.25	101.25
	February, 1899	20	....	....	....	....	....	....	20
	March, 1899	188	....	....	....	....	....	6.50	194.50
	April, 1899	214	....	81	....	....	....	14	309
	May, 1899	40	66	....	....	....	....	3.75	109.75
	June, 1899	102	22	....	....	....	35	6	165
	Total	1,269	88	382	346	10	35	75.50	2,205.50
No. 3	July, 1898	65	....	14	195	....	....	7.25	281.25
	August, 1898	140	....	23	151	....	....	27.50	341.50
	September, 1898	262	....	28	....	10	....	4.50	304.50
	October, 1898	60	....	....	....	....	....	1.75	61.75
	November, 1898	135	....	19	....	....	....	2.25	156.25
	December, 1898	125	....	146	....	....	....	1.75	272.75
	January, 1899	85	....	11	....	....	....	.25	96.25
	February, 1899	20	....	....	....	....	....	....	20
	March, 1899	208	....	....	....	....	....	6.50	214.50
	April, 1899	214	....	81	....	....	....	14	309
	May, 1899	40	66	....	....	....	....	3.75	109.75
	June, 1899	102	22	....	....	....	35	6	165
	Total	1,456	88	322	346	10	35	75.50	2,332.50

Comparative table of commerce through locks.

Items.	Lock No. 1.			Lock No. 2.			Lock No. 3.		
	Fiscal year ending June 30—			Fiscal year ending June 30—			Fiscal year ending June 30—		
	1897.	1898.	1899.	1897.	1898.	1899.	1897.	1898.	1899.
Steamboats ....number..	67	238	172	294	633	297	309	636	308
Barges ....do...	89	403	118	235	439	147	211	474	151
Steamboats ....tonnage..	(a)	6,165	3,655	(a)	13,985	6,431	(a)	13,582	6,729
Barges ....do...	(a)	29,032	5,770	(a)	33,590	7,800	(a)	25,790	8,060
Passengers ....number..	58	203	348	1,342	2,994	721	1,538	3,089	732
Lockages ....do...	228	537	220	384	774	354	551	815	372
Coal ....tons..	1,925	2,223	1,059	4,706	4,139	1,269	4,699	4,618	1,456
Corn ....do...	......	......	......	......	25	......	......	25	......
Steel rails ....do...	......	......	......	......	22	......	......	22	......
Cement ....do...	......	......	88	......	9	88	......	9	88
Stone ....do...	......	5,076	......	......	5,210	......	......	5,290	......
Sand ....do...	......	148	......	......	148	......	......	148	......
Posts ....do...	......	......	......	......	14	......	......	14	......
Cross ties ....do...	......	113	......	......	113	......	......	113	......
Hewn timber ....do...	......	5,264	......	......	5,527	......	......	5,728	......
Logs ....do...	149	4	342	165	16	392	178	74	332
Lumber ....do...	81	352	182	146	514	346	139	514	346
General and miscellaneous.do...	14	111	90	44	820	110	44	820	110
Total	2,169	13,291	1,761	5,061	16,057	2,205	5,060	16,875	2,332

a No record kept.

S 4.

IMPROVEMENT OF WARRIOR AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

This system of rivers forms the highway for the coal, etc., coming down the Black Warrior River, as well as the natural communication for western Alabama and eastern Mississippi that lies contiguous to the upper Tombigbee.

The work done on this system is divided into sections, as follows:

(*a*) Warrior River, from the mouth to Tuscaloosa, a distance of 130 miles.

(*b*) Tombigbee River, from mouth to Demopolis, a distance of 191 miles.

(*c*) Tombigbee River, from Demopolis, Ala., to Columbus, Miss., a distance of 156 miles.

(*d*) Tombigbee River, from Columbus to Fulton, a distance of 144 miles.

(*e*) Tombigbee River, from Fulton to Walkers Bridge, a distance of 24¾ miles.

The approved project on sections *a*, *b*, and *c* propose the use of locks and dams; on *d* and *e* only snagging and temporary work in the way of dikes, etc.

To keep up navigation on these rivers it will be necessary to keep up the removal of snags, drift, etc., which accumulate annually; also to do some dredging and removal of sand, gravel, etc.

As the estimates for these improvements are only for building locks and dams, it follows that the yearly expenditures for snagging, etc., reduce the amount necessary to complete the improvements as shown on paper, but really this amount is not reduced. I respectfully recommend that the appropriations hereafter be asked for separately for the operation of snag boats and parties engaged in bank work, dike work, and removing accumulations of sand, gravel, etc.

On sections *a*, *b*, and *c* there will be necessary, annually, $45,000.

(*a*) WARRIOR RIVER, ALABAMA.

For original condition of this section and for work done prior to June 30, 1898, see pages 1435 and 1436, Annual Report for 1898.

PLAN OF IMPROVEMENT.

To afford a channel of 6 feet depth from the junction with the Tombigbee River up to Tuscaloosa, Ala., a distance of 140 miles, by construction of locks and dams and jetties, by removal of logs, snags, etc., from the channel and overhanging trees from the banks.

WORK OF THE PAST YEAR.

During the year gauges at Tuscaloosa, Grays Landing, A. G. S. Bridge, and Millwood were read daily at 7 a. m. The highest flood since April, 1892, occurred during March, 1899, culminating on the 17th at 61 feet on the Tuscaloosa gauge, and overflowing the alluvial valley below. Vast quantities of driftwood were borne by the flood, and doubtless many new snags are deposited in the channel, emphasizing the need of an annual appropriation for maintenance. Little damage to farming interests resulted from the flood, as the crop had not been planted.

SURVEY.

The survey was continued from Minters Creek to Demopolis, 58½ miles, where the work was finished and the party disbanded on December 20, thus completing a careful contour survey of the Warrior River from Tuscaloosa to Demopolis, made during the working seasons of 1897 and 1898. The work consisted of running a continuous line of levels and establishing frequent bench marks; running a zigzag stadia line down the river; taking complete cross sections of river bed and banks at intervals of about 400 feet, with channel soundings between; taking 5-foot contours and prominent features of topography for a distance of 450 feet back from low-water line on either side of river; running spur lines from quarter mile to 1 mile up large branches and creeks, through all natural depressions forming channels for flood water, and across the necks of large bends; and tying the survey to land lines at intervals of about 5 miles. Spur lines usually followed branches until bed of branch was 10 feet above low water in the river, in order to show the effect of backwater from proposed dams. Stadia distances were measured on both front and back sites, and the vernier bearing was checked at intervals by observations on polaris. The party consisted of thirteen men, who lived on a quarter-boat and worked from the river banks and from skiffs.

The notes of the regular survey are plotted, excepting part of topography.

In addition to the regular survey, the party made preliminary locations for the six locks between Tuscaloosa and Demopolis, and staked out the sites.

BORINGS.

Borings for lock sites were continued until December 28, 1898, when the party was disbanded for the winter. During this time two sites were examined for Lock 6 and one site each for Locks 4 and 5, the entire site for each lock, dam, and abutment being covered by borings 10 feet apart both ways. An attempt was made also to sink several test pits at each site, but it was found impracticable with the means at hand to sink them much below the river level owing to the water and quicksand encountered.

Most of the borings were made with 1-inch steam pipe in 8-foot sections, driven down by small pile drivers. A solid conical point was screwed on the bottom joint of pipe, other joints being attached with couplings as the pipe went down. A reducer filled with lead was kept screwed on the top joint of pipe as a driving head. The pile drivers had 16-foot leads, 75-pound hammers, and were operated rapidly by a hand rope. The pipe was driven practically to refusal, then pulled up with a winch head and tackle on the pile driver, depth of boring measured and recorded, and elevation of bottom of boring ascertained from a hub of known elevation at the surface, and recorded. Two of these machines were used, and made borings 25 to 50 feet in depth quite rapidly. The objection to this method is that it does not reveal the character of the materials penetrated, except to indicate hardness by the varying penetration of the pipe for a given blow of the hammer. To obviate this objection, after the test pits proved impracticable a combined water jet and drill apparatus was built. It consisted of an outer pipe or casing 2 inches in diameter and an inner pipe 1 inch in diameter, both coupled in lengths of about 8 feet, a flat steel bit with round perforated shank was screwed into the bottom end of inner pipe, and a force pump connected through hose with the top end. The inner pipe was churned up and down by hand to break up or agitate the material under the bit, and a stream of water forced down through the same pipe came up between the two pipes, bringing with it the loosened particles, and thus enabling a record to be kept of the character of materials and the thickness of strata penetrated. This method was slower and more expensive, but gave much more satisfactory information than the pile-driver method. In lieu of the test pits several of these jet-drill borings reaching 30 to 60 feet below the bed of the river were made at each site, and in future work it is proposed to use this method altogether. The original plan for locating the lock sites was to seek places where the bed-rock strata were near enough to the bed of the stream to build on, but after a diligent search no such places were found, the solid rock being too deep under the stream for our borings to reach it at every place examined. I am therefore forced to the conclusion that Locks and Dams 4, 5, and 6 will have to be built on piles driven in strata of sand and gravel.

The first location examined for Lock No. 6 was at Burroughs Reef, where the bed of the river appeared to be of soft, solid rock. The borings revealed several thin strata of rock, with strata of fine sand between, a combination unsafe for building on, and through which it would be very difficult to drive piles. This site was abandoned and a location made at Battles Gin Bar, where no rock was found, strata of sand and coarse gravel alternating. A good pile foundation can probably be put in here without difficulty, but the river bank on the lock side is quite low. It is probable that a better location, everything considered, can be secured at Mikes Bar, and this will be examined when the boring party resumes work.

A location for Lock No. 5 was examined at Log Shoals. Here borings indicate that the abutment can be founded on soft rock and the lock and dam on piles driven into sand and gravel strata, which are found for about 30 feet below the bed of the river. Under these is a stratum of stiff clay about 25 feet thick, under which was tapped artesian water which flowed to the surface in a bold stream. It is very probable that artesian water can be secured by boring at all the Warrior Lock sites, thus adding greatly to the health of employees during and after construction. It is probable that Log Shoals is the best available site for Lock No. 5.

A location for Lock No. 4 was examined at Pickens Bar. Here no rock was found, the borings showing about 15 feet of sand and gravel under the river bed and under this a thick stratum of stiff clay, indicating that a good pile foundation can be put in without difficulty. This is probably the most suitable location for Lock No. 4.

From July 1, 1898, to December 28, 1898, 2,162 borings were made, aggregating 51,546 linear feet of pile-driver borings and 1,270 linear feet of jet-drill borings.

Since January 1, 1899, work on the maps and profiles of Warrior River survey have been prosecuted as rapidly as funds available would permit, and preliminary specifications and a general plan and estimate for Locks and Dams 4, 5, and 6 have been prepared.

No snagging or channel work was done during the year owing to lack of funds.

The total amount expended on this section to June 30, 1899, is $230,306.13.

Money statement.

July 1, 1898, balance unexpended		$7,721.74
Amount appropriated by river and harbor act approved March 3, 1899.		220,000.00
		227,721.74
June 30, 1899, amount expended during fiscal year		8,027.87
July 1, 1899, balance unexpended		219,693.87
July 1, 1899, outstanding liabilities		470.00
July 1, 1899, balance available		219,223.87
Amount (estimated) required for completion of existing project		1,100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$440,000.00	
For maintenance of improvement	15,000.00	
		455,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Appropriations were originally made as follows:

Warrior and Tombigbee rivers:	
By act of—	
March 3, 1875	$25,000
August 14, 1876	15,000
June 18, 1878	28,000
March 3, 1879	20,000
Warrior River:	
By act of—	
June 14, 1880	20,000
March 3, 1881	10,622
August 2, 1882	10,000
July 5, 1884	12,000
August 5, 1886	18,750
August 11, 1888	18,000
Total	177,372

The following appropriations have been made by Congress for present project:

By act of—

September 19, 1890	$45,000
July 13, 1892	75,000
August 18, 1894	40,000
June 3, 1896	70,000
March 3, 1899	220,000
Total	450,000

COMMERCIAL STATISTICS.

Articles.	1899.	1898.	1897.
	Tons.	*Tons.*	*Tons.*
Cotton	2,500	1,500	2,080
Grain	3,000	2,500	2,100
Iron	21	20	20
Lumber	63	60	50
General merchandise	2,400	2,000	1,300
Total	7,984	6,080	5,550

(*b*) TOMBIGBEE RIVER FROM ITS MOUTH TO DEMOPOLIS.

ORIGINAL CONDITION OF WORK.

For original condition of work and work done prior to June 30, 1898, see pages 1436, 1437, and 1438, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The present plan of improvement is to secure a channel 6 feet deep at low water, by removal of obstructions, bank revetment, and the construction of locks and dams.

WORK OF THE PAST YEAR.

Snagging and the removal of rock was carried on until August 13, 1898, by the snag boat *Tombigbee*, to the head of Rainwater Bar, 202.5 miles from Mobile; from Demopolis to Simmons Landing, 8 miles, and from Hunters Slough to Powells Landing, 12 miles.

Summary of work.

Overhanging trees cut		1
Snags removed from river		122
Stumps removed or leveled		4
Rock removed	cubic yards	155
Miles traveled		340

Borings were made at site for lock at Naheola on July 5, 6, and 7, 1898.

Work on the lock and dam at McGrews Shoal has progressed during the year, with three interruptions by high water, until the near exhaustion of funds necessitated a suspension of operations until further appropriation was made. An appropriation of $50,000 was made by act of Congress approved March 3, 1899, for completion of lock at McGrews Shoal, and preparation is now being made to resume work.

The condition of the work is now as follows: River wall completed to elevation plus 6, and bays to elevation plus 11.5; bank wall completed to elevation plus 6, including a short portion of each wing wall at the ends; lump behind lower quoin to elevation plus 11.5, and upper bay to elevation plus 11.5; coffer and miter walls completed at both ends. The two walls as far as constructed contain 4,960 cubic yards.

Guages were read daily at Blacks Bluff, Naheola, Pickens Landing, and Coffeeville, and twice daily at McGrews Shoal.

The total amount expended on this improvement to June 30, 1899, is $331,138.19.

Money statement.

July 1, 1898, balance unexpended		$16,295.16
Amount appropriated by river and harbor act approved March 3, 1899		50,000.00
		66,295.16
June 30, 1899, amount expended during fiscal year		17,433.35
July 1, 1899, balance unexpended		48,861.81
July 1, 1899, outstanding liabilities		3,007.09
July 1, 1899, balance available		45,854.72
Amount (estimated) required for completion of existing project		550,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$250,000.00	
For maintenance of improvement	15,000.00	
		265,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
September 19, 1890	$55,000
July 13, 1892	125,000
August 18, 1894	75,000
June 3, 1896	75,000
March 3, 1899	50,000
Total	380,000

COMMERCIAL STATISTICS.

Articles.	1899.	1898.	1897.
	Tons.	*Tons.*	*Tons.*
Cotton	17,250	16,250	7,800
Grain			5,525
Iron			95
Lumber	220,750	210,239	67,240
General merchandise	30,240	25,200	13,219
Total	268,240	251,689	93,879

(c) TOMBIGBEE RIVER, FROM DEMOPOLIS TO COLUMBUS.

For original condition of work and work done prior to June 30, 1898, see pages 1438 and 1439, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain a channel 6 feet deep at low water by removal of obstructions, bank revetment, and the construction of locks and dams.

WORK OF THE PAST YEAR.

One snag boat was engaged on July 1, 1898, working from Demopolis upstream, and one snag boat and one quarter-boat were working from Columbus downstream. On January 13, 1899, work was discontinued, at Epes, Ala., on account of high water, and the boats were laid up.

On June 1, 1899, operations were resumed, with one camping party at Demopolis, Ala., working upstream, and one snag boat at Jones Bluff, Ala., also working upstream.

The following is a statement of the work performed during the fiscal year ending June 30, 1899:

Snags removed from river		3,085
Stumps removed from river		788
Sunken logs removed from river		836
Sunken trees removed from river		462
Logs and stumps on banks cut up		1,783
Logs removed from drift piles		698
Overhanging trees felled, pulled back, cut up, and removed		8,249
Trees trimmed		71
Bushes cut (estimated)		15,915
Bushes cut for repair of jetties	cords	39
Brush mattresses made for repair of jetties		100
Piles driven for repair to jetties		832
Rock blasted, excavated, and removed	cubic yards	2,125
Gravel, clay, and sand excavated and removed	do	695

The condition of the improvement on June 30, 1899, is such as to allow light-draft boats to navigate from Demopolis, Ala., to Columbus, Miss., on a 2 foot rise above ordinary low water.

The total amount expended on this improvement up to June 30, 1899, is $113,941.25.

Money statement.

July 1, 1898, balance unexpended	$52,613.44
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	62,613.44
June 30, 1899, amount expended during fiscal year	16,554.69
July 1, 1899, balance unexpended	46,058.75
July 1, 1899, outstanding liabilities	963.79
July 1, 1899, balance available	45,094.96
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—

September 19, 1890	$15,000
July 13, 1892	35,000
August 18, 1894	50,000
June 3, 1896	50,000
March 3, 1899	10,000
Total	160,000

COMMERCIAL STATISTICS.

Articles.	1899.	1898.[a]	1897.[a]
	Tons.		
Cotton	813	....	....
Cotton seed	200	....	....
General merchandise	600	....	....
Total	1,613	....	....

[a] No statistics obtainable for 1898 and 1897.

(*d*) TOMBIGBEE RIVER FROM FULTON TO COLUMBUS.

For original condition of work and work done prior to June 30, 1898, see pages 1439 and 1440, Annual Report for 1898

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain high-water navigation by cutting overhanging trees and removing all obstructions above low water. Original project was completed in 1882 at a cost of $27,293.65. Subsequent work has been for maintenance.

WORK OF THE PAST YEAR.

No work was done during the fiscal year ending June 30, 1899.

The present condition of this section of river allows of the free passage of rafts of logs and timber.

The total amount expended on this improvement to June 30, 1899, is $44,875.86.

Money statement.

July 1, 1898, balance unexpended	$736.96
Amount appropriated by river and harbor act approved March 3, 1899	5,000.00
	5,736.96
June 30, 1899, amount expended during fiscal year	319.17
July 1, 1899, balance unexpended	5,417.79
July 1, 1899, outstanding liabilities	97.19
July 1, 1899, balance available	5,320.60
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made specifically for preservation of this improvement:

By act of—	
July 13, 1892	$6,000
August 18, 1894	4.000
June 3, 1896	8.000
Total	18,000

For continuing improvement and maintenance:

By act of March 3, 1899	$5,000

(e) TOMBIGBEE RIVER FROM WALKER'S BRIDGE TO FULTON.

For original condition of work and for work done prior to June 30, 1898, see page 1440, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain high-water navigation from Walker's bridge to Fulton, 25 miles, by removal of obstructions, etc. Original project was completed at a cost of $6,517.18. Subsequent work has been for maintenance.

WORK OF THE PAST YEAR.

Work was resumed on this improvement by bank party with skiffs on May 1, 1899, at Fultons Ferry, and obstructions removed downstream to Blakes Ford on June 30, 1899. The following is a statement of work performed:

Removed from river:	
Snags	348
Trees	51
Stumps	63
Logs	8
Logs and stumps on banks cut up	417
Drift piles removed	16
Overhanging trees felled, pulled back, cut up, and removed	892

The present condition of this section of river is such that light-draft boats and large rafts can navigate same on a 3-foot rise above ordinary low water.

The total amount expended on this improvement to June 30, 1899, is $13,525.92.

Money statement.

July 1, 1898, balance unexpended	$335.79
Amount appropriated by river and harbor act approved March 3, 1899	1,000.00
	1,335.79
June 30, 1899, amount expended during fiscal year	861.71
July 1, 1899, balance unexpended	474.08
July 1, 1899, outstanding liabilities	355.00
July 1, 1899, balance available	119.08
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	1,000.00

The following appropriations have been made:

By act of—	
August 11, 1888	$4,000
September 19, 1890	4,000
July 13, 1892 (maintenance)	3,000
August 18, 1894 (maintenance)	1,000
June 3, 1896 (maintenance)	1,000
March 3, 1899 (continuing improvement and maintenance)	1,000
Total	14,000

S 5.

IMPROVEMENT OF NOXUBEE RIVER, MISSISSIPPI.

For original condition of work and work done prior to June 30, 1898, see pages 1440 and 1441, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain a navigable channel for small river steamers during nine months of the year from the mouth up to Macon, Miss., by removal of obstructions, etc. Original project was completed in 1889, at a cost of $47,527.52. Work done since has been for maintenance.

WORK OF THE PAST YEAR.

Operations have been suspended on this improvement since 1896 on account of there being no navigation of the river. Navigation has been resumed during the present fiscal year, and a renewal of work of removing obstructions was commenced by bank party with skiffs on April 1, 1899, at mouth, and carried on upstream to State Line, Miss., on June 30, 1899. The following is a statement of work performed:

Removed from river:	
Snags	199
Stumps	14
Logs	115
Trees	433
Logs and stumps on banks cut up	393
Overhanging trees felled, pulled back, cut up, and removed	10,458
Bushes cut (estimated)	17,075
Trees trimmed	1
Logs removed from drift piles	23
Fish traps removed	1
Rock excavated and removed ... cubic yards	33
Clay excavated and removed ... do	11

The present condition of the river is such that light-draft boats can navigate from the mouth up 49 miles on a 6-foot stage, and thence to Macon, Miss., 42 miles, only on extreme high water.

The total amount expended on this improvement to June 30, 1899, is $59,343.01.

Money statement.

July 1, 1898, balance unexpended	$3,903.19
June 30, 1899, amount expended during fiscal year	1,246.20
July 1, 1899, balance unexpended	2,656.99
July 1, 1899, outstanding liabilities	562.18
July 1, 1899, balance available	2,094.81
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—	
June 14, 1880	$12,000
March 3, 1881	8,000
August 2, 1882	10,000
July 5, 1884	7,500
August 5, 1886	7,500
August 11, 1888	5,000
September 19, 1890	3,000
September 13, 1892 (maintenance)	3,000
August 18, 1894 (maintenance)	3,000
June 3, 1896	3,000
Total	62,000

S 6.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

For the original condition and history of this work and for work done prior to June 30, 1898, see pages 1448, 1449, and 1450, Annual Report for 1896, and pages 1692, 1693, and 1694, Annual Report for 1897.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain a channel of navigable width and minimum depth of 12 feet from Moss Point to the anchorage in the bay, a distance of 11½ miles, by dredging and construction of dam, and maintaining the river in its improved condition above Moss Point, Miss., by removal of obstructions, etc.

WORK OF THE PAST YEAR.

No work performed.

The present condition of Pascagoula River is such that vessels of 6½ feet draft can navigate to Cedar Creek, 55 miles above the mouth, all the year, and thence to the junction of Leaf and Chickasahay rivers, Mississippi, on a 6-foot rise above ordinary low water only.

The total amount expended on this improvement to June 30, 1899, is $200,500.

Money statement.

July 1, 1898, balance unexpended	$40.49
June 30, 1899, amount expended during fiscal year	40.49
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	5,000.00
Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—		
March 2, 1827	$8,000	
May 23, 1828	17,500	
August 30, 1852	5,000	
		$30,500
By act of—		
June 17, 1878	10,000	
March 3, 1879	14,000	
June 14, 1880	20,000	
March 3, 1881	4,000	
August 2, 1882	8,000	
July 5, 1884	3,000	
		59,000
By act of—		
August 5, 1886	20,000	
August 5, 1886, transferred amount appropriated for improving Horn Island Pass, act of July 5, 1884	5,000	
August 11, 1888	27,000	
September 19, 1890	20,000	
July 13, 1892	20,000	
August 18, 1894	13,000	
June 3, 1896	6,000	
		111,000
Total appropriations		200,500

S 7.

IMPROVEMENT OF PASCAGOULA RIVER AND HORN ISLAND HARBOR, MISSISSIPPI.

The condition of the proposed channel is such as to allow vessels of 9 to 9½ feet draft to ascend to the lumber mills at Moss Point, Miss.

The harbor at Horn Island has a depth of about 21 feet, excepting over the shoal known as the "Bulkhead," which divides the eastern and western parts, where there is a depth of about 17.5 feet.

PLAN OF IMPROVEMENT.

Act of Congress approved March 3, 1899, provides:

> Pascagoula River, Mississippi, and Horn Island Harbor: Improving the same as recommended by the reports dated December 28, 1896, and August 29, 1898, respectively, $50,000: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the plan of improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $267,600, exclusive of the amount herein and heretofore appropriated.

The present project for the improvement of Pascagoula River, that of December 28, 1896, is to obtain a 12-foot channel by dredging from 3 miles above the mouth of Dog River to the 12-foot contour in Mississippi Sound, 150 feet wide above railroad bridge and 300 feet wide below bridge. And the present project for improvement of Horn Island Harbor, that of August 29, 1898, is to obtain a channel in the anchorage by dredging 500 feet wide and 20 feet deep at mean low water.

WORK OF THE PAST YEAR.

Under the appropriation made by act of Congress, March 3, 1899, of $50,000, which provides that contract or contracts may be entered into by the Secretary of War for $267,600 in addition, proposals for dredging in Pascagoula River and Horn Island Harbor, Mississippi, were invited by public advertisement, dated April 25, 1899, and bids opened May 25, 1899. Some informality in the bids received caused a delay in their being forwarded to the Chief of Engineers until June 9, 1899. Up to June 30, 1899, award of contract for this dredging had not been made.

The total amount expended on this improvement to June 30, 1899, is $603.83.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899		$50,000.00
June 30, 1899, amount expended during fiscal year		603.83
July 1, 1899, balance unexpended		49,396.17
July 1, 1899, outstanding liabilities		8.63
July 1, 1899, balance available		49,387.54
Amount (estimated) required for completion of existing project		267,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$267,600.00	
For maintenance of improvement	25,000.00	
		292,600.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriation has been made:

By act of—	
March 3, 1899	$50,000
And provision that the Secretary of War may enter into contract or contracts for an additional	267,600

Abstract of proposals for dredging in Pascagoula River and Horn Island Harbor, Mississippi, opened May 25, 1899.

No.	Name and address of bidder.	Number and kind of dredges.	Number of scows.	Number of tugs.	Price per cubic yard.	
					River.	Harbor.
					Cents.	*Cents.*
1	National Dredging Co., Wilmington, Del.	Three clam-shell	9	4	32	32
[a]2	Rittenhouse Moore Dredging Co., Mobile, Ala.	Two clam-shell	(b)	2	29	29
3	Albert G. Delmas, Scranton, Miss.	Two hydraulic and one scoop.	(b)	(b)	17	34

[a] If allowed to dump material in satisfactory dumping grounds inside, will do the dredging and dumping for the sum of 23 cents per cubic yard. Recommended under conditions named in my letter of June 8, 1899.

[b] Necessary number.

NOTE.—The time of commencing and completing the work was in accordance with specifications.

COMMERCIAL STATISTICS.

Statistics furnished by United States custom-house at Pascagoula, Miss.

Vessels cleared.	1899.		1898.		1897.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.
Foreign	217	111,515	160	89,636	150	62,614
Domestic	36	12,827	61	24,178	37	17,038
Total	253	124,342	221	113,814	187	79,652

Coastwise shipments not included in United States custom-house statement.

Articles.	1899.		1898.		1897.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
Lumber and timber	54,050	$360,128	64,680	$409,360	36,649	$218,795
Rosin	7,000	120,000	4,375	75,000	3,600	54,000
Turpentine	2,500	150,000	1,250	75,000	800	58,000
Charcoal	12,000	60,000	8,000	40,000	7,800	39,000
Fish, oysters, and wool	1,858	48,500	1,265	33,250	127	1,020
Creosoted piles and timber	6,051	121,014	4,149	91,993	....	....
Total	83,459	859,642	83,719	724,603	48,976	370,815

S 8.

IMPROVEMENT OF CHICKASAHAY RIVER, MISSISSIPPI.

For original condition of work and work done prior to June 30, 1898, see page 1442, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The original project was to secure a channel from the mouth up to Shubuta, Miss., a distance of 130 miles, by removal of obstructions, etc. This project was modified by act of June 3, 1896, and section of river to be improved limited to that part from the mouth to railroad bridge at Bucatunna, Miss., 75 miles. Project was completed in 1896, at a cost of $12,399.73. Subsequent work has been for maintenance.

WORK OF THE PAST YEAR.

On May 20, 1899, work was resumed with a snag boat, commencing at the mouth and carried upstream for 20½ miles, to Prentis Ferry, on June 30, 1899. The following is a statement of the work performed:

Removed from river:	
Snags	1,400
Stumps	125
Logs	167
Logs removed from drift piles	74
Logs and stumps on banks cut up	1,346
Overhanging trees felled, pulled back, cut up, and removed	1,330
Trees trimmed	4
Bushes cut (estimated)	3,565

The condition of this river on June 30, 1899, is such as to allow light-draft boats to navigate from the mouth up to the railroad bridge at Bucatunna, Miss., on a 4-foot rise above ordinary low water, and large rafts of logs and timber to be brought down from Waynesboro, Miss.

The total amount expended on this improvement up to June 30, 1899, is $17,567.74.

Money statement.

July 1, 1898, balance unexpended	$29.04
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	2,529.04
June 30, 1899, amount expended during fiscal year	596.78
July 1, 1899, balance unexpended	1,932.26
July 1, 1899, outstanding liabilities	521.05
July 1, 1899, balance available	1,411.21
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,000
March 3, 1899	2,500
Total	19,500

COMMERCIAL STATISTICS.

Articles.	1899.	1898.	1897.
	Tons.	*Tons.*	*Tons.*
Logs and timber	90,960	22,320	15,650
Rosin	700	315	300
Turpentine	250	113	80
Grain and fertilizer		150	65
General merchandise		45	30
Staves	1,125		
Total	93,035	22,943	16,125

S 9.

IMPROVEMENT OF LEAF RIVER, MISSISSIPPI.

For original condition of work and for work done prior to June 30, 1898, see page 1442, Annual Report for 1898.

PLAN OF IMPROVEMENT.

To obtain a channel for high-water navigation from its mouth up to the mouth of Bowie Creek, a distance of 75 miles, by removal of obstructions, etc. Original project was completed in 1897, at a cost of $11,019.04, subsequent work being for maintenance.

WORK OF THE PAST YEAR.

Work was resumed on this improvement by bank party with skiffs on May 13, 1899, at Carters Bluff, Mississippi, and obstructions removed downstream to Hemphill's mill on June 30, 1899. The following is a statement of the work performed:

Removed from river:	
Snags	1,261
Stumps	116
Logs	10
Logs and stumps on banks cut up	190
Overhanging trees felled, pulled back, cut up, and removed	822

The present condition of this river is such that light-draft boats and large rafts of logs and timber can navigate from Bowie Creek to the mouth on a 3-foot rise above ordinary low water.

The total amount expended on this improvement to June 30, 1899, is $15,219.51.

Money statement.

July 1, 1898, balance unexpended	$776.22
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	3,276.22
June 30, 1899, amount expended during fiscal year	995.73
July 1, 1899, balance unexpended	2,280.49
July 1, 1899, outstanding liabilities	446.47
July 1, 1899, balance available	1,834.02
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	2,500
June 3, 1896	2,500
March 3, 1899	2,500
Total	17,500

COMMERCIAL STATISTICS.

Articles.	1899.	1898.	1897.
	Tons.	*Tons.*	*Tons.*
Logs and timber	66,000	96,360	83,640
Rosin	2,825	455	440
Turpentine	2,025	194	80
Grain and fertilizer	....	180	125
General merchandise	....	60	25
Total	70,850	97,249	84,310

S 10.

IMPROVEMENT OF CHANNEL FROM GULFPORT TO SHIP ISLAND HARBOR, MISSISSIPPI.

The depth of water over the line of the proposed channel varies from 8.9 feet to 17.9 feet, and in the proposed basin there is an average depth of about 9 feet.

PLAN OF IMPROVEMENT.

The plan of improvement is to excavate a channel and anchorage basin of 19 feet at mean low water from the pierhead next the shore at Gulfport, Miss., through the Mississippi Sound, to the 19-foot curve in the anchorage at Ship Island Harbor, Mississippi.

Act of Congress approved March 3, 1899, provides:

> Gulfport, Miss., to Ship Island Harbor: The Secretary of War is hereby authorized to enter into a contract or contracts to dredge a channel 300 feet wide and 19 feet deep at mean low water from the anchorage at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, in Harrison County, in the State of Mississippi, and to construct at the end of said channel next the shore an anchorage basin of similar depth, not less than 2,610 feet by 1,320 feet in area, at a cost not to exceed $150,000; and the Secretary of War is further authorized to contract for the maintenance of said channel and anchorage basin for the term of five years after its completion for the sum of $10,000 annually: *Provided*, That the necessary expenses for such examinations, surveys, and inspections of the work as may be required from time to time to determine whether the channel and anchorage basin are dredged and maintained as required by this act shall be paid from the permanent indefinite appropriation made by section 4 of the river and harbor act approved July 5, 1884: *And provided further*, That the depths provided for shall be at mean low water as determined by the engineer officer in local charge of the work.

Proposals for dredging and maintaining channel and basin in Mississippi Sound, Mississippi, between Ship Island Harbor and Gulfport, Miss., were advertised for on May 10, 1899, and no bids received.

S 11.

IMPROVEMENT OF SHIP ISLAND PASS, MISSISSIPPI.

The condition of the proposed channel is such as to allow vessels of 20 to 21 feet draft to ascend to the anchorage of Ship Island Harbor, Mississippi.

PLAN OF IMPROVEMENT.

The plan of improvement is to excavate a channel of 26 feet at mean low water across Ship Island Bar from the inner to the outer 26-foot curve in the Gulf of Mexico.

Act of Congress approved March 3, 1899, provides:

> Ship Island Pass, Mississippi: To complete a channel through Ship Island Pass, with a depth of 26 feet, in accordance with the report and estimate printed in House Document No. 120, Fifty-fifth Congress, third session, $40,000.

Proposals for dredging were advertised for on April 25, 1899, and bids opened on May 25, 1899. Contract was awarded to the National Dredging Company, of Wilmington, Del., at 22.5 cents per cubic yard, on June 12, 1899.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899		$40,000.00
June 30, 1899, amount expended during fiscal year		378.70
July 1, 1899, balance unexpended		39,621.30
July 1, 1899, outstanding liabilities	$8.63	
July 1, 1899, amount covered by uncompleted contracts	35,000.00	
		35,008.63
July 1, 1899, balance available		4,612.67

The following appropriation was made:

By act of March 3, 1899	$40,000

Abstract of proposals for dredging in Ship Island Pass, Miss., opened May 25, 1899.

No.	Name and address of bidder.	Number and kind of dredge.	Number of scows.	Number of tugs.	Price per cubic yard.
					Cents.
[a]1	National Dredging Co., Wilmington, Del.	Two clam-shell and 1 scoop.	9	4	22.5
2	Rittenhouse Moore Dredging Co., Mobile, Ala.				24

[a] Recommended for acceptance.

NOTE.—The time for commencing and completing the work was in accordance with specifications.

CONTRACTS IN FORCE.

With National Dredging Company, dated June 12, 1899, approved by the Chief of Engineers July 7, 1899, for dredging at the rate of 22½ cents per cubic yard. Work to commence August 12, 1899; to be completed December 31, 1899.

S 12.

IMPROVEMENT OF PEARL RIVER AT ITS MOUTH, MISSISSIPPI.

The condition of the proposed channel is such as to allow vessels of 7 to 7½ feet draft to ascend to the lumber mills located on East and West Pearl rivers, Mississippi.

PLAN OF IMPROVEMENT.

The present plan of improvement is to excavate a channel 300 feet wide and 9 feet deep at mean low water from the 9-foot curve at the mouth of East Pearl River, Mississippi, across the bar to the 9-foot curve in Mississippi Sound.

A previous project (see Report of Chief of Engineers, 1885, page 1367) was submitted for a channel 100 feet wide and 12 feet deep at mean low water, and by acts of August 11, 1888, and September 19, 1890, $10,000 was appropriated to dredge this channel; but as it is necessary to cross other bars over which there is a least depth of about 9 feet at mean low water, the present project, as above stated, was finally adopted.

Act of Congress approved March 3, 1899, provides:

> Mouth of Pearl River, Mississippi: Completing improvement in accordance with the project dated December 23, 1896, $18,199.80.

Proposals for dredging were advertised for on April 25, 1899, and bids opened on May 25, 1899. Contract was awarded to the National Dredging Company, of Wilmington, Del., at 27 cents per cubic yard, on June 12, 1899.

Money statement.

July 1, 1898, balance unexpended	[1]$9,945.35
Amount appropriated by river and harbor act approved March 3, 1899	18,199.80
	28,145.15
June 30, 1899, amount expended during fiscal year	162.20
July 1, 1899, balance unexpended	27,982.95
July 1, 1899, outstanding liabilities	8.63
July 1, 1899, balance available	27,974.32

The following appropriations have been made:

By act of—	
August 11, 1888	$5,000.00
September 19, 1890	5,000.00
March 3, 1899	18,199.80
Total	28,199.80

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[1] See "statement," Improvement Pearl River below Jackson.

Abstract of proposals for dredging at the mouth of Pearl River, Mississippi, opened May 25, 1899.

No.	Name and address of bidder.	Number and kind of dredge.	Number of scows.	Number of tugs.	Price per cubic yard.
					Cents.
a 1	National Dredging Company, Wilmington, Del.	Two clam shell and 1 scoop.	9	4	27
2	Jno. J. Keegan, New Orleans, La				28
3	Rittenhouse Moore Dredging Co., Mobile, Ala.				29

a Recommended for acceptance.

NOTE.—The time for commencing and completing the work was in accordance with specifications.

CONTRACTS IN FORCE.

With National Dredging Company, dated June 12, 1899, approved by the Chief of Engineers July 7, 1899, for dredging, at the rate of 27 cents per cubic yard. Work to commence August 12, 1899; to be completed December 31, 1899.

S 13.

IMPROVEMENT OF PEARL RIVER BELOW JACKSON, MISS.

For original condition of this work and for work done prior to June 30, 1898, see pages 1443 and 1444, Annual Report for 1898.

PLAN OF IMPROVEMENT.

To afford a 2-foot channel from the mouth at the Rigolets up to Jackson, Miss., a distance of 315 miles, by removal of obstructions, etc.

WORK OF THE PAST YEAR.

Operations were resumed with a snag boat on May 1, 1899, at the head of Holmes Bayou, and 9¼ miles of river was worked over to June 30, 1899. The following is a statement of the work performed:

Removed from river:	
Snags	193
Stumps	104
Logs	130
Logs on banks cut up	175
Logs removed from drift piles	1,108
Overhanging trees felled, pulled back, cut up, and removed	1,463
Bushes cut (estimated), cords	15

The present condition of this section of river is such as to allow navigation by light-draft boats all through the year from the mouth to Monticello, Miss., 160¾ miles; thence to Jackson, Miss., 151¼ miles, the river can be navigated on a rise of 6 or 7 feet above low water only.

The total amount expended on this improvement to June 30, 1899, is $148,696.51.

Money statement.

July 1, 1898, balance unexpended		[1]$880.36
Amount appropriated by river and harbor act approved March 3, 1899		7,000.00
		7,880.36
June 30, 1899, amount expended during fiscal year		1,397.22
July 1, 1899, balance unexpended		6,483.14
July 1, 1899, outstanding liabilities		524.44
July 1, 1899, balance available		5,958.70
Amount (estimated) required for completion of existing project		33,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	7,000.00	
		17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

The following appropriations have been made:

By act of—		
June 14, 1880	$30,000	
March 3, 1881	25,000	
August 2, 1882	15,000	
July 5, 1884	10,000	
August 5, 1886	13,125	
August 11, 1888[2]	15,000	
September 19, 1890[2]	20,000	
July 13, 1892	15,000	
August 18, 1894	5,000	
June 3, 1896	10,000	
March 3, 1899	7,000	
		$165,125
Amount reported under improvement of mouth of Pearl River		10,000
Total		155,125

COMMERCIAL STATISTICS.

Articles.	1899.	1898.[a]	1897.[a]
	Tons.		
Saw logs, pine	26,074		
Lumber	28,634		
Total	54,708		

[a] No statistics for these years obtainable.

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[1] Does not include $9,945.35 appropriated for dredging at mouth and included in last year's report.

[2] Of each of these appropriations the law required $5,000 to be applied to dredging at mouth of Pearl River.

S 14.

IMPROVEMENT OF PEARL RIVER BETWEEN CARTHAGE AND JACKSON, MISSISSIPPI.

For original condition of work and work done prior to June 30, 1898, see pages 1444 and 1445, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to afford a channel of navigable width and 2 feet deep at mean low water from Carthage to Jackson, a distance of 105 miles, by removal of obstructions, etc. This project was completed in 1893 at a cost of $26,014.98, subsequent work being for maintenance.

WORK OF THE PAST YEAR.

On July 1, 1898, work was in progress on this section of river. A bank party with skiffs worked from Flat Boat Cut-off downstream to Forked Pine Bluff, Mississippi, 29 miles, to August 15, 1898, when operations were suspended on account of lack of funds. The following is a statement of work performed:

Removed from river:	
Snags	3,660
Logs	780
Stumps	237
Logs and stumps on banks cut up	554
Logs removed from drift piles	214
Overhanging trees felled, pulled back, cut up, and removed	1,807
Trees trimmed	3
Bushes cut (estimated)	3,490

The condition of the improvement on June 30, 1899, is such as to allow light-draft boats to navigate on a 3-foot rise above ordinary low water from Carthage to Jackson.

The total amount expended on this improvement to June 30, 1899, is $35,969.

Money statement.

July 1, 1898, balance unexpended	$632.20
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	3,132.20
June 30, 1899, amount expended during fiscal year	551.20
July 1, 1899, balance unexpended	2,581.00
July 1, 1899, outstanding liabilities	86.78
July 1, 1899, balance available	2,494.22
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	2,400.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—		By act of—	
March 3, 1879	$6,000	July 13, 1892	$5,000
June 14, 1880	7,[illegible]00	August 18, 1894	2,400
March 3, 1881	2,500	June 3, 1896	2,400
August 2, 1882	2,500	March 3, 1899	2,500
August 6, 1886	2,250		
August 11, 1888	2,500	Total	38,550
September 19, 1890	3,000		

S 15.

IMPROVEMENT OF PEARL RIVER BETWEEN EDINBURG AND CARTHAGE, MISSISSIPPI.

For original condition of work and work done prior to June 30, 1898, see page 1445, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to afford a high-water channel for use of steamers during six or eight months of the year for a distance of 23¾ miles, by removal of obstructions, etc. Original project was completed in 1893 at a cost of $10,662.49, subsequent work being for maintenance.

WORK OF THE PAST YEAR.

Work was resumed on May 1, 1899, by bank party with skiffs at Edinburg, Miss., and carried on downstream to Pine Bluff on June 30, 1899. The following is a statement of work performed:

Removed from river:	
Snags	2,685
Stumps	799
Logs	560
Logs and stumps on banks cut up	654
Drift piles removed	4
Overhanging trees felled, pulled back, cut up, and removed	1,013
Trees trimmed	104
Bushes cut (estimated)	5,165

The condition of this section of river on June 30, 1899, is such as to allow light draft boats to navigate from Edinburg to Carthage on a 4-foot rise above ordinary low water.

The total amount expended on this improvement to June 30, 1899, is $16,552.13.

Money statement.

July 1, 1898, balance unexpended	$291.88
Amount appropriated by river and harbor act approved March 3, 1899	1,000.00
	1,291.88
June 30, 1899, amount expended during fiscal year	594.01
July 1, 1899, balance unexpended	697.87
July 1, 1899, outstanding liabilities	320.60
July 1, 1899, balance available	377.27
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—		By act of—	
July 5, 1884	$2,500	August 18, 1894 (maintenance)	$500
August 5, 1886	2,250	June 3, 1896 (maintenance)	500
August 11, 1888	5,000	March 3, 1899 (maintenance)	1,000
September 19, 1890	5,000		
July 13, 1892 (maintenance)	500	Total	17,250

S 16.

IMPROVEMENT OF BOGUE CHITTO, LOUISIANA.

For original condition of work and for work done prior to June 30, 1898, see pages 1445 and 1446, Annual Report for 1898.

PLAN OF IMPROVEMENT.

The plan of improvement is to afford a channel 3 feet deep at mean low water from the mouth up to Alford's bridge, near Summit, Miss., a distance of 190 miles, by removal of obstructions, bank work, etc.

WORK OF THE PAST YEAR.

On July 1, 1898, work was in progress at head of Middle Bogue, and was carried upstream 3¾ miles to September 6, 1898, when operations were suspended on account of lack of funds. Work was resumed under appropriation made by act of March 3, 1899, on May 1, 1899, at the mouth of the river and carried upstream to West Bogue on June 30, 1899. The following is a statement of the work performed during the year:

Removed from river:	
Snags	73
Stumps	107
Logs	58
Logs and stumps on banks cut up	108
Overhanging trees felled, pulled back, cut up, and removed	692
Bushes cut, estimated	16,325
Gravel and sand excavated and deposited in dams ... cubic yards	2,389
Brush cut and made into mattresses and deposited in dams ... cords	40

The present condition of this river is such as to allow light-draft boats and large rafts of logs and timber to navigate for a distance of 79¾ miles above the mouth, and on a 3-foot rise navigation may be carried on 110¼ miles farther upstream.

The total amount expended on this improvement to June 30, 1899, is $20,789.74.

Money statement.

July 1, 1898, balance unexpended		$1,303.53
Amount appropriated by river and harbor act approved March 3, 1899		5,000.00
		6,303.53
June 30, 1899, amount expended during fiscal year		2,093.27
July 1, 1899, balance unexpended		4,210.26
July 1, 1899, outstanding liabilities		514.85
July 1, 1899, balance available		3,695.41
Amount (estimated) required for completion of existing project		30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$10,000.00	
For maintenance of improvement	3,000.00	
		13,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	5,000
March 3, 1899	5,000
Total	25,000

COMMERCIAL STATISTICS.

Articles.	1899.	1898.	1897.
	Tons.	*Tons.*	*Tons.*
Logs and timber, pine	14,000	8,457	6,720
Logs and timber, cypress	4,000	4,475	60
Total	18,000	12,932	6,780

S 17.

SURVEY FOR CANAL BETWEEN WARRIOR RIVER AND FIVE-MILE CREEK, ALABAMA.

The sundry civil act of June 4, 1897, directed that a survey be made for canal between Warrior River and Five-mile Creek, Alabama, the expenses of which survey were to be paid from the unexpended balance of appropriation for improving Black Warrior River from Tuscaloosa to Daniels Creek.

This survey was begun August 14, 1897, and carried on until February 28, 1898, three parties being occupied—two on topography, etc., and one on precise-level work. All field work was completed, and report, together with maps, drawings, estimates, etc., was forwarded with letter dated November 19, 1898, and published as House Doc. No. 88, Fifty-fifth Congress, third session.

SURVEY OF WATERWAY BETWEEN WARRIOR RIVER AND FIVE-MILE CREEK, ALABAMA, VIA VALLEY RIVER, BESSEMER, AND BIRMINGHAM.

[Printed in House Doc. No. 88, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 13, 1898.

SIR: I have the honor to submit the accompanying report of November 19, 1898, with map,[1] by Maj. William T. Rossell, Corps of Engineers, of a survey made in compliance with requirements of the sundry civil act of June 4, 1897, to examine into the feasibility and advisability of the improvement of the waterway beginning at a point at or near the site selected for Lock No. 13, on the Warrior River, and continuing up Valley River from its mouth to Bessemer, Ala., thence to Birmingham, Ala., and beyond to Five-mile Creek, so as to secure a channel to have a minimum depth of 6 feet, with a least width of 50 feet at the water line, and to ascertain the cost of such improvement.

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[1] Not reprinted. Printed in House Doc. No. 88, Fifty-fifth Congress, third session.

Major Rossell states that the country through which the Valley River runs is very broken and rocky, with high banks; that there is no danger to be apprehended from overflows caused by fixed dams; that stone for construction is everywhere available; that there is no question of the feasibility of building this line, and that, if the work is confined at present to canalizing Valley River and building storage reservoirs for supplying the canal with water in times of drought, the project is both feasible and advisable.

The project for this improvement contemplates the construction of 21 dams and locks of 10 feet lift, between the Warrior River and McAdory (about 40 miles), a storage-reservoir dam at Big Blue Creek, one at Little Blue Creek, and two at McAdory, and the estimated cost of the entire work, including damages, water powers, snubbing posts, telegraph and telephone lines, contingencies, and the construction of a railroad for transporting materials, is $4,500,000.

A separate project is presented for continuing the improvement by canal to Five-mile Creek. It provides for construction between McAdory and Five-mile Creek (about 23 miles) of 13 locks and dams and a reservoir dam, and the estimated cost of this work, including miscellaneous items and contingencies, is $4,000,000; but the local engineer states that it is doubtful if the canal can be operated throughout the year on account of insufficiency of water supply.

In forwarding this report to this office the division engineer, Col. Peter C. Hains, Corps of Engineers, states that, as the water supply for the Valley division, from McAdory Creek to Five-mile Creek, is not sufficient to feed the canal, the construction of that part of the waterway is not advisable, and for the reason that the projected improvement ends at the Warrior River, which is not deep enough to carry the freight to tide water, he does not concur in the opinion of the district engineer that the improvement of the river division, from Warrior River to McAdory Creek, is feasible and advisable. He remarks, however, that if the Warrior River were improved so as to give a 6-foot navigable depth from the mouth of Valley Creek to the Tombigbee, and the latter so improved as to carry that depth to the Gulf, the improvement of Valley Creek would perhaps be a desirable work, forming one link in the chain from the coal fields to the Gulf.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJ. WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., November 19, 1898.

GENERAL: The sundry civil act approved June 4, 1897, provides for a survey, as follows:

> That the Secretary of War be, and he hereby is, directed to cause a survey to be made to examine into the feasibility and advisability of the improvement of the waterway beginning at a point at or near the site selected for lock numbered thirteen, on the Warrior River, and continuing up Valley River from its mouth, following the general course of said stream to Bessemer, Alabama; thence up the Valley to Birmingham and beyond to Five-mile Creek, at a point where sufficient head

can be obtained to supply water for that part of said route between Five-mile Creek and Bessemer, Alabama, so as to secure a channel to have a minimum depth of six feet and be at least fifty feet in width at the water line, and to ascertain the cost of such improvement, and the cost of such survey shall be defrayed from the unexpended balance of the funds heretofore appropriated for the improvement of the Black Warrior River from Tuscaloosa to Daniels Creek.

I was charged with the duty of making this survey by letter from the Chief of Engineers, United States Army, dated June 10, 1897. I at once prepared a project for the work and, as soon as the same had been approved, took steps to organize surveying parties and put them in the field. Mr. Joseph Ripley, assistant engineer in the Detroit district, was temporarily furloughed from that district and given charge of the survey. I kept in constant communication with Mr. Ripley during the progress of the work and agree with him generally in the conclusions drawn. His report, a valuable one, is inclosed, and attention is invited to it for many details.

I also inclose the report of Mr. O. W. Ferguson, surveyor in charge of precise-level party, together with a complete list of bench marks established by his party.

The improvement desired, and to decide the feasibility and advisability of which this survey is made, has for its object the ultimate forming of a waterway with all-the-year-round navigation from the coal, iron, and lime regions of central Alabama to tide water at Mobile, Ala.

The Birmingham district, which to-day probably dictates the price of pig iron to the world, is the objective. It lies in and adjacent to Jones Valley in north central Alabama. This district seldom exceeds 3 to 4 miles in width, and is the divide between the Cahaba River on the east and Warrior River on the west. These rivers both flow in a southerly direction, and their waters unite in the Mobile River. To the north of the district lies the valley of the Tennessee River. The connection of the famous district with tide water by a navigable waterway has been proposed many times, and advantages have been claimed for each of the three routes, viz, via Warrior River; via Cahaba River, and via Tennessee River. I had hoped to have been given authority to examine all these routes and thereby collect such data as would by discussion settle which of these routes would be most advantageously used. By the language of the law, however, I have been restricted to the route via the Warrior River, and also to one line only to this river.

The line proposed, and which the law requires to be surveyed, leaves the Warrior River at the mouth of Valley River; thence follows up this river (Valley River), passing into Jones Valley through the gap of this river. The line from this gap to the terminus near the head waters of Five-mile Creek is along the valley of the western slope of West Red Mountain. This latter part makes use of the valleys of Village and Five-mile creeks.

An examination of the route shows that waterway is naturally divided into two parts: First, from the head waters of Five-mile Creek to gap in the mountains at Valley River; and second, from this point to the Warrior River. The first is a true canal and the second a canalized river. As will be noticed on profile sheet 1,* the whole line is laid out so that there are but few places where the canal will be in fill. This reduces loss from filtration, and also dangers in construction, to minimum.

The length of canalized river is about 40 miles and of canal proper 23 miles. The country through which the Valley River runs is very broken and rocky, with high banks. There is no danger to be apprehended from overflows caused by fixed dams, and stone for construction is everywhere available. There is, however, no line of communication for bringing cement, iron, etc. To remedy this, a railroad will have to be built, equipped, and operated by the United States or the contractor doing the work. The saving in freights and delays will more than pay the cost of this road. I have carefully gone over the plats to see if high lifts could be used with economy, instead of ordinary locks and dams, and I find that locks with lifts of 10 feet are the best for the whole line. There is no question of the feasibility of building this line, and the only question is as to the feasibility of operating it—that is, is there enough water available for this purpose. At the time of the survey all streams were very low and there had been a long-continued drought. The amount of water then in Valley River at the summit level of this part was not enough to operate the canal, so that it will be necessary to make a storage reservoir at or near McAdory. The valleys at that point are very favorable for that purpose. Two dams are recommended, which together will impound enough water to supply the canal for three months without rain. In the canal proper a storage reservoir must be built at the head waters of Five-mile Creek, but even with this it is doubtful if the canal can be operated throughout the year. If, however, the work is confined at present to canalizing Valley River and building storage reservoirs, which can also be used as loading basins, the savings on freights will be enough to build up a large export trade, and I can answer that the project is both feasible and advisable.

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*Only the general map and profile printed.

In carrying out this work all land for reservoirs, and a marginal strip 150 feet wide, should be purchased. Both banks of Valley River should be purchased to a width of 150 feet, widening out on both sides at locks to 300 feet; also right of way for railroad, and building, equipping, and operating same during construction. Telephone lines and electric-lighting plants should be put in. Turning and passing basins must be made in each level.

Should the traffic become in the future so great that the storage reservoirs at McAdory Mills could not supply enough water, then a storage reservoir may be built near head waters of Five-mile Creek, and a feeder constructed to bring the water to Valley River.

ESTIMATE OF COST.

I estimate the cost of this canal somewhat higher than Assistant Engineer Ripley, as follows:

From mouth of Valley River to and including—	
Lock 1	$156,000
Lock 2	147,000
Lock 3	155,000
Lock 4	150,000
Lock 5	151,000
Lock 6	149,000
Lock 7	147,000
Lock 8	145,000
Lock 9	148,000
Lock 10	145,000
Lock 11	160,000
Lock 12	148,000
Lock 13	145,000
Lock 14	151,000
Lock 15	145,000
Lock 16	147,000
Lock 17	149,000

Big Blue Creek Reservoir Dam	$18,000
To and including—	
Lock 18	147,000
Lock 19	161,000
Lock 20	152,000
Little Blue Creek Reservoir Dam	26,000
To and including Lock 21	148,000
Lock 21 to upper end of loading basin	130,000
McAdory Reservoir Dam, 50-foot head	300,000
Reservoir Dam 2, at McAdory Creek, 30-foot head	200,000
Miscellaneous, including railroad, damages, water powers, snubbing posts, telegraph and telephone lines, etc	400,000
Engineering and contingencies	280,000
Total estimate for canalizing Valley River from McAdory Mill to Warrior River	4,500,000

Estimate for canal proper from near headwaters of Five-mile Creek to McAdory.

From upper end of loading basin on Valley River to and including—	
Lock 22	$116,000
Lock 23	167,000
Lock 24	142,000
Lock 25	275,000
Lock 26	161,000
Lock 27	180,000
Lock 28	173,000
Lock 29	148,000
Lock 30	143,000
Lock 31	117,000
Lock 32	119,000
Lock 33	103,000
Lock 34	550,000
Lock 34 to reservoir dam	701,000
Reservoir dam to Five-mile Creek	415,000
Miscellaneous, including electric lights, telegraph and telephone lines, keepers' dwellings at spillways, etc	107,000
Engineering and contingencies	383,000
Total estimate for canal proper, from head waters of Five-mile Creek to McAdory	4,000,000

Respectfully submitted.

William T. Rossell,
Major, Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. Engineer Office,
Baltimore, Md., December 3, 1898.

Respectfully submitted to the Chief of Engineers.

The report of the district engineer shows that the water supply for the Valley division, from McAdory Creek to Five-mile Creek, is not sufficient to feed the canal, consequently the construction of that part of the waterway is not advisable.

In respect to the River division, viz, the part from the Warrior River to McAdory Creek, the district engineer regards that as both feasible and advisable. I do not concur in this opinion. Assuming that the estimate, $4,500,000, is ample, which I think doubtful because of the unsatisfactory manner in which appropriations are made, there still remains the fact that the improvement ends at the Warrior River, which is not deep enough to carry the freight to tide water.

If the Warrior River were improved so as to give a 6-foot navigable depth from the mouth of Valley Creek to the Tombigbee, and the latter so improved as to carry that depth to the Gulf, the improvement of Valley Creek would perhaps be a desirable work, forming one link in the chain from the coal fields to the Gulf.

The projects for the improvement of the two rivers, Warrior and Tombigbee, it will be seen by reference to the annual report of the district engineer, are reported as indefinite. To improve Valley Creek, therefore, without adopting definite projects for the improvement of the Warrior and Tombigbee, would involve expenditures wholly out of proportion to the benefits to be accomplished.

The improvement of Valley Creek should form an integral part of a system reaching from the coal fields of northern Alabama to the Gulf of Mexico.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

REPORT OF ASSISTANT ENGINEER JOSEPH RIPLEY.

MAJOR: I have the honor to submit the following report on the feasibility and advisability of making a waterway channel at least 6 feet deep and 50 feet wide from the Warrior River to Bessemer, Ala., by the way of Valley River, and thence up Possum Valley past Birmingham to the reservoir site on Five-mile Creek.

The Appalachian mountain system extends roughly parallel to the Atlantic coast from Canada to central Alabama.

The Birmingham district is in the northern part of central Alabama, and located in and adjacent to Jones Valley, which seldom exceeds 3 or 4 miles in width, and is part of Long Valley, which for 100 miles is a divide between the swiftly running Warrior and Cahaba rivers.

The floor of the valley is 500 to 650 feet above sea level, and its edges are rocky ridges whose crests are 700 to 1,200 feet above sea level. Adjacent to the valley on each side is a confused mass of ridges and steep hills, with the intervening valleys having their longer axes parallel to the southwesterly trend of the ranges. These valleys and hills vary from 200 to 700 feet in elevation above sea level. Crossing the country every few miles are large creeks with rapid currents, which rise in springs along the southeasterly divide and flow northwesterly in serpentine channels, between high hills, and along the base of overhanging rocky bluffs to the Warrior River, or similarly in a southeasterly direction to the Cahaba River. The shortest distance from Birmingham to the Warrior River is 15 miles and to the Cahaba River 8 miles.

Valley River rises in Birmingham and, though its mouth is only 24 miles distant, the stream is 60 miles long. It flows southwesterly for 20 miles to West Red Mountain, on western edge of the valley, thence is deflected northwest, its course being an extremely tortuous one for the remaining 40 miles. Five-mile Creek is 8 miles northeast of Birmingham. The country is heavily timbered with oak, pine, cedar, etc.

Surveys.—The arrangements having been made therefor, I was furloughed for six months by Col. G. J. Lydecker, of the Detroit district, and reported to you at Mobile, Ala., on August 17, 1897. The next day I proceeded to Birmingham and spent four days making an examination of the route of the proposed canal to determine the character and extent of the surveys and the methods to be used in making them. Thence went to Vicksburg, Miss., to examine precise level outfit. Returning to Mobile, prepared classified lists and received bids for camp equipment to be delivered at Birmingham by September 9. As no instruments were available in the Mobile district for this survey, one transit and two levels, rods, etc., were purchased, one transit and one plane table borrowed from Col. G. J. Lydecker, Detroit district, and one precise level and two rods from Maj. J. H. Willard, Vicksburg district.

One precise level and two topographical parties were organized, the members being selected in most cases from those in the civil-service lists and who were immediately available.

LIST OF MEMBERS.

Topographical parties.

M. G. Barnes, chief of party.
W. R. Caldwell, transitman.
J. D. Garrison, levelman.
R. E. Tilden, recorder.
Henry Geismer, rodman and levelman.
George B. Kelley, rodman and recorder.
G. A. Fox, tapeman and foreman.
Arthur Betts, tapeman.
W. H. Hall, rodman.
Two teamsters with teams.
Five laborers, colored.
One cook, colored.
Andrew J. Swift, chief of party.
Boykin W. Pegues, transitman.
Charles E. Thompson, levelman.
W. H. Rippey, recorder.
J. C. Owen, rodman and foreman.
R. M. Williamson, tapeman.
W. M. Huey, tapeman.
F. M. Milner, rodman.
One teamster with team.
Five laborers, colored.
One cook, colored.

Precise level party.

O. W. Ferguson, chief of party.
Edgar C. Thompson, recorder.
J. F. Ghormley, rodman.
O. D. Sorrell, rodman.
B. P. Williams, umbrellaman.
J. S. McDonald, axeman.
One cook, colored.

Teams were hired when required to move camp.

The two topographical parties went into camp on September 11, 8 miles northeast of Birmingham. It was impossible to establish a system of triangulation within the allotted time and cost, as all lines of sight between stations would have to be cleared through heavy timber or the stations built from 15 to 80 feet high.

Traverse lines.—A primary traverse line was located along and adjacent to the proposed canal route. The stations were either oak hubs driven in the ground or one-half inch holes drilled in bed rock or in pieces of stone about 1 foot square, which were buried 2½ feet below the surface of the ground. The locations of all stations were witnessed with reference to two or more trees. The angles between stations were measured by three repetitions of the angle to the right, and then by three repetitions to the left, the limit of error between the two being ten seconds. At ten camp sites azimuth was determined from star observations. The azimuths carried along the main traverse line between camp sites checked well with the corresponding observed azimuths, after allowing for changes due to difference in longitude and latitude.

The distances between traverse stations were measured with steel tapes, plumbing to the ground from both ends of either the partial or full lengths of the 100-foot tapes. The limit of error between forward and back measurements was 1 in 5,000 and was exceeded on an average of 1 course in 20, thus necessitating a second measurement. With the exception of 10 miles the lines were over a rough, hilly, and thickly wooded country, having a difference in elevation of 400 feet between the highest and lowest points on the line. Among the hills measured over were the following ones:

(1) Height, 90 feet; length of slopes, 249 and 375 feet.
(2) Height, 130 feet; length of slopes, 600 and 800 feet.
(3) Height, 65 feet; length of slopes, 120 and 125 feet.

On the 26½ miles in the valley division run by Mr. Swift's party the forward measurements were greater than the back measurements by 0.66 foot. The total excess of forward over the back measurements was 3.55 feet and of the back over the forward was 2.89 feet. There were 128 courses, having an average length of 1,087.72 feet. The error was 1 in 211,000, or 0.005 foot per course. The daily rate for making duplicate measurements of traverse lines was 7,735 feet. Number of angles read was 11, covering a distance of 11,600 feet.

On the 36¾ miles of river division run by Mr. Barnes's party, the forward measurements were 2.77 feet less than the back measurements. The total excess of forward measurements was 4.72 feet, and of the back measurements was 7.49 feet. There were 462 courses, having a mean length of 417.98 feet. The error was 1 in 70,000, or 0.006 of a foot per course. The daily rate for making duplicate measurements of traverse lines was 7,329 feet. Number of angles read, 15, with 5 additional set-ups on brow of hills to prolong lines; instrumental work covering 8,396 feet of line daily. The total of differences between forward and back measurements was 2.11 feet in 63 miles. The above distances are relative, not absolute, as no corrections were made for temperature changes, differences in sag, errors of graduation, etc. The coordinates of all traverse stations were computed with reference to a common origin at △ North Base, located at Neaves Ford, on Five-mile Creek.

Levels.—Check levels, opposite in direction, were run along all the primary traverse lines, and heights determined of traverse stations, base of rails on railroads, bridge abutments, outcropping ledges of rock, water surface along streams at least every 1,000 feet. Also extra lines of levels were run at intervals across the valleys. Bench marks were established about every half mile, and are (*a*) ½-inch by 6-inch boat spikes, driven in notch on root of trees, with a washer under head of spike, on which is stamped its number, and (*b*) 2-inch squares cut around a slightly more elevated portion of a bowlder or rock in place. A full description and detail sketch of adjacent topography was made of each bench mark. From a reduction of the level notes the following results were obtained: On a loop from U. S. P. B. M., 3, in Birmingham, to U. S. P. B. M., 5, in Bessemer, a distance of 12 miles along the Alabama Great Southern Railroad, with the precise level, O. W. Ferguson, observer, the fall was 78.80 feet; via Village and Possum creeks, a distance of 20 miles, with a wye level, C. E. Thompson, observer, the fall was 79.03 feet, a discrepancy of 0.22 of a foot. On a loop from U. S. P. B. M., 5, in Bessemer, to old bench mark 4, on Lock 1, in Tuscaloosa, a distance of 48½ miles along the Alabama Great Southern Railroad, with the precise level, O. W. Ferguson, observer, the fall was 400.718 feet; via Valley and Warrior rivers, a distance of 84 miles, with a wye level, C. E. Thompson, J. B. Garrison, H. Geismer, and W. A. Jones, observers, the fall was 401.373 feet, a discrepancy of 0.655 of a foot.

Topography.—An accurate and detailed stadia survey was made of the valley and boundary ridges along the traverse lines, the width varying from one-fourth to over 1 mile, and also the survey was extended up all tributaries for such distances till their beds were 50 feet above Valley River. Special attention was given to locating contours, and readings were taken to water surface every 100 feet along streams. Outcroppings of rock were noted the entire length of the survey, except for a distance of 5 miles on the divide along Possum Valley. Borings were taken on this portion, and depth of wells noted.

Gauging of streams.—Eight weirs were built and measurements taken of flow of water in streams during the low stage. Two cross sections, 200 feet apart, were located across the streams near weirs. Levels were taken every 5 feet on cross sections, extending on each side above high water. Current velocities were determined with floats early in February. The Birmingham Waterworks Canal was gauged in September and again in February.

Precise levels.—To accurately determine the elevations above mean low water at Mobile, duplicate lines of precise levels were run from Birmingham, Ala., along the Alabama Great Southern Railroad to Meridian, Miss., connecting there with the bench mark which had been established by the United States Coast Survey with reference to mean Gulf level at Biloxi, Miss.

The precise-level party went into camp September 27, 3 miles below Birmingham, the organization having been delayed by the yellow-fever quarantine. The field work was finished to Meridian February 28, 1898; during March an additional line was run 28 miles between York and Demopolis. A supplemental report on the precise-level work will be submitted on completion of the office reduction and discussion of field notes.

Expenditure statement.—Bids were received for groceries each month, but open-market purchases were made when advantageous or necessary. Ten thousand nine hundred and fifty-four meals were furnished, at a cost of 8½ cents per meal for provisions and 3½ cents for wages of cooks.

Field work, topographical parties	$5,366.43
Field work, precise-level party	2,375.04
Superintendence and office work	3,410.00
Inspection, traveling expenses, etc	165.10
Instruments, including expressage	308.45
Camp equipment	690.28
Stationery	90.99
Total	12,406.29

Office work.—The following maps and sketches have been made, and are respectfully submitted with this report:

Topography platted on 24 field sheets, each 25 inches by 40 inches, to a scale of 1 to 5,000;

Profiles platted of river and valley divisions, and of the Feeder Canal, to the scale of 1 inch equals 15 feet vertical and 400 feet horizontal;

Topography adjacent to 120 bench marks sketched, six on a page;

A general map of the district and profile of canal to a scale of 1 to 100,000 horizontal and 1 to 1,000 vertical;

One sheet showing cross sections of canal, locks, dams, etc.

At least a month's office work would have been saved if the correct elevations could have been used from the first and the tools had been received in time, so that both topographical parties could have been started at McAdory.

The successful completion of the surveys in the allotted time is due to the judgment, energy, and toil of chiefs of parties, instrument men, and to the individual members, each of whom cheerfully did his best at all times.

For many courtesies, valuable information, and assistance received we are especially indebted to Messrs. Julian Kendrick, J. A. Van Hoose, J. A. Milner, Rivers Carter, J. D. Elliott, and A. A. Tyler. Through the courtesy of Mr. J. B. Bingham, collector of internal revenue, the free use of a large, well-furnished room in the post-office building was placed at our disposal, and was used for a computing and drafting room for three months after the completion of field work in December.

PROJECT.

The feasibility of the project depends on the possibility of canalizing about 40 miles of Valley River, making 23 miles of canal in excavation on the summit level, and on the amount of water which can be obtained for the summit level and dependent slope. Hereafter the part canalized will be called the River division and the part in excavation the Valley division.

Besides the requirement for lockages, leakage, and evaporation, the excess during high water must be such that a sufficient quantity can be stored to last during the dry season. The amount of water needed for a canal depends principally upon the size and lift of locks, upon its cross-sectional dimensions, and upon the traffic. The locks at Tuscaloosa are 52 feet wide, 322 feet long between gates, with 6½ feet of water over miter sills at lowest stage. It takes fifteen minutes to make a lockage for a launch, and at least thirty minutes for a tow of four barges.

A single lockage can be made through the Weitzel Lock, St. Marys Falls Canal, Michigan, in eleven minutes, while the average time of lockage for a number of years has been forty minutes, the handling of tows more than doubling the time of filling and emptying lock and operating gates. Therefore, the probable maximum traffic through the canal will not exceed 48 lockages per day. If all vessels were locking up, each would require one lockful of water plus the displacement of the vessel; if all were locking down, one lockful less displacement. If alternating up and down, each would require one-half lockful, neglecting difference between displacements. The mean is taken at two-thirds of a lockful for each, making the movement of boats two to one in opposite directions. The maximum lift of locks to be supplied entirely from summit level is 11 feet. For one lockful the amount is 184,184 cubic feet, and the daily requirement for traffic would be 5,893,888 cubic feet, or 4,093 cubic feet per minute.

Leakage at gates is sometimes taken at 12 lockfuls a day, making in this case 1,535 cubic feet per minute.

Evaporation.—The only data obtained for evaporation in this district were from the daily observations from the waterworks company, which they stated was sometimes as high as one-fourth of an inch per day. For a canal 50 feet wide at the water surface the evaporation per mile per minute is 3½ feet at above rate.

Filtration.—This is variable with material, cuts, embankments, construction, and whether canal is above or below adjacent drainage. Applying the rule that "filtration varies as the product of the wet perimeter by the depth," for the 23½ miles of the Valley division, and using the measured value of 229 cubic feet per mile per minute for filtration on the Erie Canal, dimensions 70 feet water surface by 52.5 feet bottom width by 7 feet depth, it amounts to 3,570 cubic feet per minute.

Water required for 23½ miles on summit level.

	Cubic feet per minute.	Cubic feet daily.
For lockage	4,093	5,893,888
For gate leakage	1,535	2,210,208
For evaporation	82	118,080
For filtration	3,570	5,140,800
Total		13,362,976

The 13½ million cubic feet is daily maximum that could not be exceeded, and only used on the supposition that the construction was very faulty and the canal built through extremely unfavorable material. Actually the canal across summit level is nearly all in excavation, 14½ miles in limestone rock and 4⅓ in earth. The earth portion of 4⅓ miles on the divide is of clay mixed with gravel, with the grade at or near rock. There will be an embankment for 4⅓ miles, with the water surface from 1 to 7 feet above original ground surface. With the above favorable conditions the construction can be readily made so that the total daily loss will not exceed 3 inches in depth from the Valley division. More than 4 inches should not be allowed without making necessary repairs to remedy defects of construction and improvements in methods of operation. On the Ohio canals the practice is to calculate 100 cubic feet per mile per minute for everything except lockage. On that basis the amount required will be:

	Cubic feet per minute.	Cubic feet daily.
For lockage	4,093	5,893,888
For leakage and evaporation, 23⅓ miles summit level, at 103½ cubic feet per mile per minute	2,415	3,477,600
Total	....	9,371,488

The 3½ cubic feet per mile per minute is equal to a loss of one-fourth of an inch daily from evaporation, and the 100 cubic feet is equal to a daily loss of 6½ inches from the Valley division.

The total area of the Valley River watershed is 240 square miles. The available drainage area of Five-mile and Village creeks, from which can be obtained the water supply for the summit level and slope, covers about 54 square miles. The subdivisions are as follows:

	Square miles.	Square miles.	Square miles.
Five-mile Creek:			
Headwaters tributary to reservoir site	19		
Barton Branch, between reservoir site and Neaves Ford	4		
		23	
Village Creek:			
Head waters to North Birmingham		31	
			54
Valley River and tributaries:			
Head waters at Birmingham to Possum Creek	38		
Possum Creek to McAdory Creek	20		
Possum Creek	10		
McAdory Creek	13		
		81	
Little Blue Creek	4		
Big Blue Creek	16		
Lick Creek	16		
Rock Creek	29		
Mud Creek	53		
Adjacent to Valley River, between McAdory Creek and Warrior River	41		
		159	
			240
Total		....	294

In a geological report it is stated that the mean annual rainfall at Birmingham is 55 inches. The only obtainable data was furnished by Mr. Ben M. Jacobs, of the State weather bureau, and covers a period of five years.

Table mean monthly rainfall, Birmingham, Ala.

	1893.	1894.	1895.	1896.	1897.	1898.	Sums.	Means.	Least.	Greatest.
January	......	3.49	6.69	3.40	4.35	5.18	23.11	4.622	3.40	6.69
February	......	4.49	3.56	4.39	4.03	......	16.47	4.118	3.56	4.49
March	......	4.44	9.14	4.41	6.98	......	24.97	6.242	4.41	9.14
April	2.55	4.48	3.27	4.87	5.09	......	20.26	4.052	2.55	5.09
May	6.60	3.27	4.01	3.19	3.93	......	21.00	4.200	3.19	6.60
June	3.25	2.80	2.99	4.29	3.63	......	16.96	3.392	2.80	4.29
July	1.45	4.20	6.10	3.35	6.16	......	21.26	4.252	1.45	6.16
August	3.85	4.76	3.19	2.26	4.49	......	18.55	3.710	2.26	4.49
September	5.67	.85	1.27	.68	1.15	......	9.62	1.924	0.68	5.67
October	.55	2.96	2.75	1.28	.56	......	8.10	1.620	0.55	2.96
November	2.13	.73	2.13	3.80	.84	......	9.63	1.926	.73	3.80
December	3.06	4.73	5.44	1.07	6.52	......	20.82	4.164	1.07	6.52
Sums	29.11	41.20	50.54	36.99	47.73	......	......	44.222	......	......
Annual means	3.234	3.433	4.212	3.082	3.978	......	......	3.685	......	......

About one-half of the total rainfall during the year takes place between the 1st of January and the 1st of June. The least annual rainfall is 37 inches.

Table of gaugings.

	Weirs.			Floats.				
	Date.	Flow per second.	Flow daily.	Date.	Area of cross section.	Mean velocity per second.	Flow per second.	Flow daily.
	1897.	*Cubic feet.*	*Cubic feet.*	1898.	*Square feet.*	*Feet.*	*Cubic feet.*	*Cubic feet.*
Birmingham Waterworks pipe site, reservoir dam	Sept. 20	3.409	294,537	Feb. 2	5.6	0.90	5.04	435,456
Five-mile Creek:								
Site, reservoir dam	Sept. 22	0.864	74,650					
Neaves Ford	Sept. 21	1.97	170,208	Feb. 2	47.7	0.234	11.167	964,829
Village Creek:								
Sloss Furnace, North Birmingham	Oct. 9	2.69	232,416					
Below Thomas Furnace	Oct. 30	2.09	180,576	Feb. 2	94.205	0.286	26.96	2,329,344
Valley River:								
Near Weavers Mill	Oct. 11	12.84	1,109,376					
1½ miles from mouth	Nov. 24	12.11	1,046,304	Feb. 4	391.14	0.64	252.2	21,790,114
Near Jones Mill	Dec. 3	28.68	2,477,952	Feb. 1	112.74	0.67	75.88	6,556,032
McAdory Creek:								
1½ miles above mouth	Dec. 3	1.165	100,656	Feb. 1	14.754	1.03	15.21	1,314,144

The survey was made during the driest season known in forty years or more. Without exception all the settlers stated that the streams were the lowest ever known by them. Many springs that had not failed before were dry for two or more months. There was no water flowing from streams emptying in Valley River below McAdory Creek.

The weir gaugings therefore show the minimum flow of streams. At Jones Mill there had been two days of drizzling rain with a fall of 1.53 inches when stream flow was measured December 3. From the limited data taken it is found that the stream flow varied from 23 to 90 per cent of the 2.55 inches of rain water which fell during the one hundred days of the dry season, August 20 to December 1, 1897, no allowance being made for stored water at beginning of dry season. The higher percentages were from areas on which were large springs, and part of their supply may have been several miles distant from their apparent watersheds.

Reservoirs.—The basins of all the creeks emptying into Valley River below McAdory can be made into storage reservoirs by building small dams between the bridges at the mouth of the creeks. The most favorable ones are the Little and Big Blue creeks, 3½ and 6½ miles, respectively, below McAdory; their storage capacities over areas of 52 and 23 acres, with the water raised 10 feet above Valley River, are 18½ and 5 million cubic feet, respectively. For each foot of rise, the increased capacity would be 2½ million and 1 million cubic feet additional.

There are two natural sites for large reservoirs, both being basins inclosed with high hills and ridges, having creeks flowing through them, with their outlets located between rocky bluffs about 700 feet apart.

The one at McAdory is 18 miles southwest of Birmingham and at the head of the proposed canalization of Valley River, and is located between McShan, West Red, and Sand mountains. The two valleys extend for 2 or 3 miles between the mountain ridges, with an average width of 1,000 feet. Covering an area of 230 acres, the storage capacity is 328,891,150 cubic feet, with 50 feet head of water at the dam; or the same capacity can be obtained with two 30-foot dams, the acreage being nearly doubled.

It will take nearly 11 inches of water from the 13 square miles of tributary drainage area of McAdory Creek to fill the reservoir. If taken during the five months from January 1 to June 1, it will be 53 per cent of the lowest rainfall of 20.19 inches for those months.

The second reservoir site is 8 miles northeast of Birmingham and located on Five-mile Creek. It is 1½ miles long and for a flooded area of 226 acres the storage capacity is 247,535,375 cubic feet, with the water 50 feet deep at the dam. The storage capacity will be greatly reduced by having two or more levels with dams for 20 to 30 feet depth of water. It will take 5½ inches of water over the 19 square miles of drainage area to fill the reservoir. If taken during the first five months of the year, it will be 27 per cent of the lowest amount of rainfall of 20.19 inches for that period.

The minimum stream flow of Five-mile and Village creeks of 7½ cubic feet per second, together with ninety days' supply in reservoir, will give a daily flow of 3,398,393 cubic feet, a little less than the daily loss for leakage and evaporation from the Valley division.

The canal crosses Five-mile and Village creeks near their sources on Red Mountain, and the descent of these streams is so steep that the rainfall is carried off rapidly, the rise being quite large and sudden, then receding so that three or four days after a rainstorm the surface of the streams is but little higher than during low water. With the exception of portion stored in reservoir for summer use, and that immediately used for lockage purposes, the excess must be wasted, so that during the high-water period there will be many days without a sufficient supply. The gaugings taken in February, two days after a rain, will probably give about the average flow during high water. The amount was 43 cubic feet per second for the two streams, or only two-fifths of amount required for maximum traffic.

The canal can be operated the entire year. The delays due to making necessary repairs to locks and hindrances during the highest flood stages will probably not exceed fifteen days.

At 9¼ million cubic feet daily, the yearly water supply needed will be over 3¼ billion cubic feet, which would take 27 inches of water from the drainage area of 54 square miles. Taken together with the low and high water gaugings, the conclusion must be that it is impracticable to supply a canal with water between Five-mile Creek and Valley River for the maximum yearly traffic.

If 13 inches of the rainfall can be stored and used to the best advantage, a yearly navigation of 12 lockages per day can be maintained on the Valley division.

The summit level can be made in Jones Valley, the upper end beginning about 3½ miles southwest of Bessemer. From Warrior River to McAdory the lifts vary from 8 to 12½ feet, but for locks entirely dependent for water taken from summit level only, the maximum lift is 10 feet. Then for one lockful the amount required is 167,440 cubic feet, and the daily requirement for maximum lockage of 48 passages is 5,358,080 cubic feet, or 3,721 cubic feet per minute. There will be little if any filtration along Valley River on account of streams having rock sides and bed and being lower than the inclosing hills. The evaporation need be considered for a distance of only 3½ miles, as the Blue Creek reservoirs will make good all loss from evaporation, leakage, and extra requirements for the 2½ feet in height of increased lock capacity of two locks.

Amount of water required for 3.5 miles of summit level.

	Cubic feet per minute.	Cubic feet daily.
For lockages	3,721	5,358,240
For leakage and evaporation 3.5 miles summit level, at 110 feet per mile per minute	385	555,400
Total	4,106	5,913,640

For 6,000,000 cubic feet daily, equal to 2,100,000,000 annual allowance, it will take 11¼ inches of water from the drainage area of 81 square miles, which is well within the amount surely available with absolute certainty.

The minimum flow of 12.11 cubic feet per second of Valley River, together with ninety days' supply in McAdory reservoir, will give a daily flow of 4,700,650 cubic feet, which will provide for about three-fourths of maximum traffic, or sixty-seven days for the maximum traffic, together with 6 lockages per day for the remaining twenty-three days of the dry season of three months. The capacity of the reservoir can be increased for ninety days' supply by building a second dam for 30 feet head of water about 1 mile farther up the creek.

The watersheds of Jones and Possum valleys are on a limestone-rock foundation covered with clay, sand, and gravel, thus making them equalizing reservoirs which are admirably adapted to supply large quantities of ground water to Valley River. Generally 70 per cent of rain water will run off in stream flow, one-half of which, or 35 per cent of total rainfall, can be utilized for lockages, and part of the remaining 35 per cent will make good all losses of evaporation from reservoirs, loading basins, etc., the surplus passing over the dams.

To satisfactorily determine the relationship between annual rainfall, evaporation, and stream flow for the separate drainage areas a series of gaugings and observations should be made for at least one year, and if practicable for several years.

DESCRIPTION OF CANAL AND EXPLANATION OF ESTIMATES.

RIVER DIVISION.

Among the physical features of that part of Valley River located between Jones Valley and Warrior River are the rocky bluffs, 20 to 300 feet high, which generally skirt the stream on each side alternately, but in three places approach closely enough to form gorges. The bed and sides of the river are of sandstone or slate rocks. Its width at extreme low water varies from 60 to 225 feet. One hundred and sixty-nine of its 240 square miles of drainage area is below the summit level of the valley in which it rises; five of seven of its main tributaries empty in this reach of the river and are the only ones which have no flow during the dry season. Its flood stage is 15 feet higher than at extreme low water, as determined from evidences of drift in the brush along banks and from marks made on beech trees by settlers who have noticed and marked the limit of floods for several years.

The stream is 38½ miles long from upper end of McAdory Basin to the Warrior River, while the distance in a straight line is 15½ miles. The fall is 213 feet, quite uniformly distributed, none of the rapids having a descent of over 5 feet in one-fourth of a mile. The water power has been utilized in several places, but at present there are only four mills in operation—one saw and three grist mills, each having a cotton gin in addition. The value of machinery, dams, and buildings is estimated at $5,000. This does not cover the value of the water power as a vested right, as it is not known whether that right belongs to the Government or to the users.

The improvements necessary to provide slack-water navigation in Valley River include the construction of dams with adjoining locks, so that pools will be formed of the required depth, and also the building of storage reservoirs, so that the regimen of the stream can be controlled. The use of bear-trap dams for lock gates and dams having low permanent substructure with adjustable tops would be advantageous, especially during times of flood. The probable excess of leakage would be so objectionable that no further consideration is given them in this discussion. There are three sites where high lifts of 50 feet can be obtained, but only two where the adjacent lands will not be flooded. The first is 15 miles and the second 33 miles from Warrior River.

Either hydraulic or pneumatic lifts will make possible a considerable saving in water, but would be in the case only when the lifts take the place of all masonry locks on this division. Generally the troughs or boxes of lift are only large enough for one boat. The time saved per boat on passage through canal, even if entire lift was located at one place, depends on the amount of traffic. The saving for one boat having a clear run will be the difference between the time delayed at lift and that at all the locks, but for the maximum traffic the average per boat may be simply the difference between time of operation of lift and that of one lock, as in former instance the vessels will make run of canal and have to wait their turn to pass the lift, while in a canal with a lockage system properly distributed the same time will be spent in passing through the series of locks.

The cost of two 50-foot lifts will exceed that of the proposed 10 locks, as Valley River is not adapted by nature for high lifts. The dams for 50 feet of water should be 500 feet long, and would have to be of masonry to safely pass the flood waters over their crests.

As the proposed canal will be a continuation of the Black Warrior River system of improvements it should correspond with that system. Three locks have been built at Tuscaloosa, and while improvements and changes may be made for remainder of locks to be built it is not known what will be their nature and extent. About the only change suggested is the substitution of concrete for rubble masonry.

The adopted lift of about 10 feet is the most advantageous for obtaining a safe and economical construction of dams adjacent to locks. The construction of the dams at Locks 1, 2, and 3, at Tuscaloosa, consists of a timber crib built in place and bolted to the rock bed of the river, the stone filling forming part of a masonry wall of dry rubble, the downstream face being built of large, selected stones, well bonded and stepped with 2-foot offsets along entire slope; the upstream face is covered with plank having a batter of 1½ to 1; the space above toe being filled with earth and gravel. The bottom width is 26 feet and the height 15 feet.

As the dams in Valley River must be water-tight, an addition to the above construction is made by building a concrete core 8 feet wide at base, which is to be placed in a trench excavated 1 foot deep in solid rock; the top width of core to be 5 feet, the upstream batter being 1 foot and the downstream 2 feet. The concrete to be also well bonded by selected large, rough stone with the rubble wall. The space between concrete and crib to be filled with puddled clay. The length of dams will be from 60 to 200 feet, instead of 650 feet, which is length of Dam No. 3 at Tuscaloosa. Similarly, as for the Warrior River dams, it is designed that the streams discharge their surplus waters over the crests of the dams, which act as waste weirs.

The reservoirs, together with the pools in Valley River, will regulate the flood heights of that stream so that the rise will not exceed 10 feet, while the flood rise in the Warrior River is in places from 60 to 70 feet in less than ten hours. Size of locks to be the same as those at Tuscaloosa, which are 52 feet wide, 322 feet long between gates, with 286 feet of available length, and depth of 6½ feet on the miter sills at low water. The lock sites have been selected with reference to grade planes, so that little or no excavation will be necessary at upper end of pools to obtain 6½ feet of water, being opposite perpendicular cliffs, so that the ends of dams will tie into rock face of same, and not need wing walls; straight reaches of 2,000 or more feet long, so as to give good approaches to either end of lock, having mouths of creeks near upper end of pools, keeping the distances between locks such that tows can make the run between adjacent locks while a double lockage is being made. This will permit the maximum lockage by avoiding waiting delays at locks, having all locks along north bank of river for reasons pertaining to construction and operation. The depth of pools directly above locks will vary from 15 to 19 feet, diminishing to at least 8, and in some places to 6½ feet just below locks. The lowering of pools when filling locks will not injure the boats, as the depth is sufficient to prevent them striking on bottom of channel. The large pool above Lock 21, near McAdory, will make the best harbor and turning basin.

The following is a tabulated statement of the lockage and curvature of Valley River.

The plane of reference of low-water surface of the Warrior River after improvement of that stream up to Valley River, is 210 feet above mean low water at Mobile, Ala.

Lockage, elevations, and curvature of the Birmingham Canal.

RIVER DIVISION.

	No. of lock.	Lift.	Elevation above Warrior River.	Distance between locks.		Curvature.			
				Feet.	Total feet.	100 to 200	200 to 300	300 to 1,000	1,000 to 4,000
From Warrior River	1	10	10	7,800	7,800	......	......	4	......
	2	10	20	10,000	17,800	......	......	3	1
	3	10	30	7,000	24,800	......	......	2	2
Thomas Ford									
	4	10	40	8,000	32,800	......	......	......	2
The Narrows									
	5	10	50	5,000	37,800	......	......	2	......
Mud Creek									
	6	10	60	18,000	55,800	......	......	4	4
Vines Mill									
Toadvine	7	10	70	6,200	62,000	......	......	3	......
High Lift									
Toadvine Mill	8	10	80	16,800	78,800	......	3	4	......
	9	10	90	6,500	85,800	......	3	2	1
Rock Creek	10	10	100	15,500	100,800	......	3	4	1
Iron Bridge									
Tuscaloosa road	11	10	110	10,500	111,300	......	1	3	1
	12	10	120	13,500	124,800	......	2	3	......
Tuckers Bend									
Lick Creek	13	10	130	15,500	140,300	......	4	5	1
Scotts Ford									
	14	10	140	5,700	146,000	1	1	1	3
	15	12½	152½	6,800	152,800	1	2	2	1
	16	12½	165	4,500	157,300	......	1	2	......
Big Blue Creek	17	10	175	4,300	161,600	......	......	3	......
	18	10	185	6,200	167,800	1	......	2	1
Iron bridge, Adger road	19	8	193	7,200	175,000	1	......	4	1
Little Blue Creek									
	20	10	203	10,600	185,600	3	5	1	......
Jones Mill									
	21	10	213	7,300	192,900	3	1	......	......
McAdory to upper end of loading basin	......	......	....	9,100	202,000	......	......	......	......
Total	......	......	....	....	....	10	25	54	19

The cross section and alignment of a waterway governs the speed attainable. The established rules for canals of large size having busy traffic and for speed rates of 5 to 7 miles per hour are as follows: That width of bottom of canal shall be twice the greatest width of the vessel plus 16 to 50 feet for vessels carrying 300 to 7,000 tons; depth, 1½ to 4 feet more than draft; and the sectional area 4 to 6 times the midship section, and the radius of curvature not less than 1,600 feet. Asst. Engineer R. C. McCalla, jr., of the Tuscaloosa locks, states that the most suitable size for tow barges on the Warrior River is 24 feet beam by 140 feet long and 7 feet deep, with capacity of about 500 tons on 6 feet draft. Four such barges, or three barges and a steamer, can be passed through the lock at one lockage; 15 to 20 barges to be handled in one tow below Demopolis.

The width of Valley River is three to six times the above width for barges. The midship section of barge is 24 feet by 6 feet, equals 144 square feet. The least cross section of channel after improvement will be over 600 square feet and the greatest 3,000, or four to twenty times mid-section of barge. The depth will exceed requirements, except at lower entrance to some of the locks, where the speed is necessarily restricted. The shortest distance between adjacent locks is 4,300 feet and the greatest 18,000 feet, and on that reach the eight bends have a large enough radius of curvature so that a speed of 4 miles per hour can be easily made with a tow of four barges.

The most difficult portion to navigate is the 10,600 feet between locks 19 and 20. Here are located the three bends having the greatest curvature of any on the river, one of them having a radius of only 120 feet, and there are also five other bends, having from 200 to 300 feet radii. Here a speed of 2 miles per hour can be generally made. With possible speed rate of 2 to 4 miles per hour on the different stretches, all the locks will be kept in continuous operation during the time of maximum traffic. To assist tows in rounding bends allowance has been made for oak snubbing posts along banks, averaging ten to the mile on each side of the river. Night navigation can be maintained only by having a system of lights properly distributed at locks, bends, and other difficult places to navigate. The estimates provide for about ten electrical lights to each mile of river and two at each lock.

Telegraph and telephone communication is essential along entire length of stream, connecting with all the locks and keepers' dwellings, the wires to be along tops of bluffs, above flood waters. Two iron highway bridges, each about 100 feet long, cross Valley River. The estimates are $50 per foot, or $20,000 for replacing the two with swing bridges. There are five public fords used during low water. No estimates have been made for providing crossings at those places.

The depth of water in Valley River during the dry season was from 18 inches in pools to less than 1 inch deep on many of the natural rock weirs, and frequently the ledge rock projected above the water surface. In places large pieces of rock have fallen into the stream from the cliffs. The low-water surface has been taken for the reference plane of improvements—that is, at least 6¼ feet is to be obtained above surface of low water. Below some of the lock sites the fallen rock and projecting ledges will have to be removed. As the work is scattered, the estimate therefor is $2 per cubic yard.

It is deemed desirable for the United States to own the right of way for a width of at least 300 feet, with 20 acres additional at each lock site and all reservoir and loading basin areas. This will prevent adjacent landowners encroaching on the stream with docks, coal tipples, etc., to the detriment of navigation interests. The public rights in canal can be enjoyed to fullest extent by granting revocable licenses for loading privileges, etc.

The assessed valuation of lands along Valley River for the year 1897 was 50 cents to $2 per acre for surface rights, the average being about $1, and from $1 to $3 per acre for mineral rights. The farmers state that their selling price is from $1 to $2 per acre for surface rights, and that most of them have sold the mineral rights to corporations for $10 per acre. Several officials of the corporations owning land along Valley River state that they will donate or sell for a nominal sum the required right of way through their lands. The estimates are therefore placed at $5 per acre, which included both surface and mineral rights.

To prevent the blocking of channel with fallen trees the estimates include the cost of clearing the trees for a width of 50 feet on each side of the stream.

Reservoir dams.—The reservoir site on McAdory Creek can be built for a storage capacity of about 330,000,000 cubic feet by constructing a dam for 50 feet head of water between the rocky ridges one-fourth of a mile above the mouth of the creek. The estimates are for stripping to solid rock, breaking same into rough depressions, and excavating 50-foot spillways in rock at each end of dam; a concrete wall 6 feet wide at base, narrowing to 3 feet at top, to prevent leakage from settlement, crawfish, or rats; on the upstream side a wall of puddled clay 20 feet wide at the bottom, narrowing to 10 feet at top; then layers of mixed clay and gravel well rammed, making the slope 3 horizontal to 1 vertical; a strip 15 feet wide from top edge to be covered with 12-inch paving stones; the lower face to be stepped off in dry rubble masonry with slopes of 3 to 1; the slopes to be seeded with Bermuda grass; the water for canal to pass through base of dam in masonry culverts provided with regulating gates.

With the top of dam 10 feet above proposed water surface, there will be no danger of flood waters passing over crest of dam. Considering the possibility that at a time when the reservoir is full and the ground thoroughly saturated the improbable supposititious case should occur of 1 inch of storm water from the 13 square miles of drainage area reaching the reservoir in one hour of even flow, this is ten times the maximum floods of the Croton watershed. At first the rise would be rapid, then gradually checking till the water was 2 feet below crest of dam, or 8 feet deep in the spillways, each 50 feet wide, the capacity of which would then be equal to the inflow. Besides the two spillways, a third one, 150 feet long, can be made for $5,000 on the divide one-half mile southeast of the dam. With the three spillways the depth of water in them would be about 4 feet.

If preferable, for the estimated cost of $327,300 a concrete dam 50 wide at the base and 12 feet at top can be built instead of the earth dam. The storage capacity of this reservoir can be increased so as to obtain ninety days' supply of water for maximum locking through canal by building another dam across a narrow place in valley, about 1 mile farther upstream, the upper level having 30 feet head of water. The cost of dam would be $184,300, which is not included in the regular estimates, but is given in the supplemental one.

The estimates provide for similarly constructed dams across the Little and Big Blue creeks. The former is 470 feet long and 23 feet high, and the latter 250 feet long and 18 feet high for a head of 10 feet of water. With a lift of 20 feet a small lock for two barges can be built for $50,000, which would extend navigation up to Big Blue Creek to the coal mines at Adger. The above-mentioned lock is not included in the estimates.

Three miles south of Birmingham the outlet of city sewer system empties into Valley Creek. The use of the stream as a drain for sewage is so objectionable that it must be avoided before canalization of the river. Mr. Julian Kendrick, city engineer, states that surveys will be made during 1898 for locating a site for a sewage farm and filter beds.

Estimates.—Building material found along the canal route comprises the oak and pine timber, of which there will be enough along the right of way and on reservoir sites to supply the amount needed for construction purposes. There are numerous places near the stream where good building stone of slates and sandstones can be quarried for masonry, concrete, or other purposes. Clay suitable for puddling is found at intervals in the adjacent hills. Sand of poor quality, but which might answer for some building purposes, was found on Mud Creek. There is no good building sand in the Birmingham district. For city work sand is shipped from Tuscaloosa or Hull, 55 to 65 miles distant, for $1.15 per cubic yard, in car lots, or $1 in larger quantities. Sand is worth 50 cents per cubic yard, f. o. b., in cars or barges at Tuscaloosa, but probably can be obtained for 40 cents for the large amount needed for locks.

Common labor is cheaper than in the Northern sections of the country, the wages paid ranging from 50 cents to $1 per day.

The estimates of quantities and cost of materials for dams and locks are based on the cost to the United States of the dams and locks at Tuscaloosa, which were built by hired labor and purchase of material. However, the unit prices have been increased for some of the items and the quantities carefully computed for the varying conditions at the several lock sites. It is proposed to use concrete in place of coursed rubble masonry. The concrete for lock walls and dams to be of Portland cement, sand, and broken stone in the proportions of 1, 2, and 3, and also 1, 2, and 5 by measure. When practicable to do so, large pieces of well-shaped and rough stone are to be built in walls, etc., so as to vertically bond the horizontal layers of concrete together, and also to lessen cost.

The estimates are also based on the building of the canal in at least three years, time. Although there are about 200 miles of chert roads in Jefferson County, which are as hard and smooth as the best macadamized roads and do not wear in ruts, the roads near Valley River are mostly dirt roads. Several of them follow along banks of stream for short distances and others cross it in several places. The hills are so steep that the teaming of material, machinery, supplies, etc., to the several lock sites will be too slow and costly. The building of one lock at a time from Warrior River up would permit cheap transportation, but would take at least ten years for construction. To canalize the river and build the locks in two or three years, a railroad should be built along north side of Valley River from McAdory to the Warrior, together with the necessary spurs to and sidings at lock sites.

The cost of the mineral roads now in operation between the iron and coal mines through a similarly rough country has been from $7,000 to $10,000 per mile. It is probable that one or more of the railroad companies, which own most of the mineral rights between Jones Valley and the Warrior River, will build this branch line, in which case the estimates can be reduced $324,000 for cost of road, but unit prices should be slightly increased for higher freight charges.

VALLEY DIVISION.

The inner boundary ridges of Jones Valley are locally known as Red Mountain and West Red Mountain, together with the valley itself. They are formed of the pushed-up rocks of formations between the Lower Silurian and the Carboniferous, and they divide the coal measures of the country on either side. For 6 miles from Five-mile Creek to North Birmingham a minor ridge of Red Mountain narrows the west part of valley to 1 mile in width. The divide between Birmingham and North Birmingham is 60 feet above Village Creek in latter place and 30 feet above the car tracks in Union Depot in Birmingham.

Village Creek skirts along the ridge for 3 miles to the divide between it and Possum Creek; there a gap in West Red Mountain gives it an outlet from the valley. The city of Birmingham extends across Jones Valley, the resident parts covering the highlands of both mountains, and is separated from Possum Valley by West Red Mountain. Ten miles southwest from Birmingham and 3 miles northeast from Bessemer the two valleys join where Possum Creek empties into Valley River. The cost of right of way through the city and the heavy cutting necessary to get water for operating purposes from Village and Five-mile creeks make it inadvisable to locate the canal along Jones Valley. The location follows the line of Possum Valley, as shown on map transmitted with your preliminary report of November 28, 1896, also on accompanying general map.

The length of canal between Five-mile Creek Reservoir and the McAdory Basin is 23¼ miles. The fall is 135 feet, the greater part—i. e., 125 feet—is located in the 10 miles south of the Possum Divide. The project includes 8 locks of 10-foot lift and 5 locks with 11-foot lift. The lock sites have been selected with reference to having rock foundations for walls; having canal in excavation where possible, so that water surface will be below natural surface of ground, thus lessening filtration, and also being a safer construction; having location immediately above road and railroad crossings, thus making unnecessary any changes in grades or elevation of tracks.

There are no dams at lock sites, as it is designed to pass the surplus waters during high or flood stages of Five-mile and Village creeks and Valley River at mouth of Possum Creek through sluiceways in the present channels of those streams. The coping of lock walls as planned will be 5 feet above the water in the canal, which is to be maintained at about the same elevation. This will require less masonry for the lock walls than for those in the river division. For a distance of about 1 mile on the Possum Divide the line follows along a macadamized road but little traveled. After completion the east bank of the canal can be used for a roadway. The long rock cut, 23½ feet deep at places, located above Lock 34 in North Birmingham, can be greatly diminished by building another lock, but in doing so would lose the flow from Barton Branch and 10 feet depth of the stored water in reservoir. The traffic on this reach will be unimportant, as there are only two dolomite quarries adjacent thereto. In fact, if the above reach was built of a sufficient size for a feeder canal only it would answer all reasonable purposes.

The alignment of the canal is fairly good and will permit a sufficient speed between locks.

The lockage, elevations, and curvature is given in the following table:

Lockage, elevations, and curvature of the Birmingham Canal.

VALLEY DIVISION.

	No. of lock.	Lift.	Elevation above Warrior River.	Distance between locks.		Curvature.			
				Feet.	Total feet.	100 to 200.	200 to 300.	300 to 1,000.	1,000 to 4,000.
Upper end loading basin	22	10	223	2,000	2,000	1	......	......	1
Maury									
	23	10	233	5,000	7,000	......	......	......	......
Old Jonesboro	24	10	243	4,000	11,000	......	1	......	......
Iron bridge, Bessemer road									
Railroad at bend									
3 railroads, L. & N., K. C., and A. G. S. R.									
Howard Harrison Works	25	10	253	11,300	22,300	......	......	2	1
Possum Creek									
Woodward Furnace	26	10	263	5,700	28,000	......	1	2	......
	27	10	273	4,500	32,500	......	......	2	1
Hughes Island	28	11	284	3,500	36,000	......	......	2	1
	29	11	295	3,000	39,000	......	......	3	......
Tuscaloosa road	30	11	306	3,000	42,000	......	......	2	1
	31	10	316	3,000	45,000	......	......	2	......

Lockage, elevations, and curvature of the Birmingham Canal—Continued.

VALLEY DIVISION—Continued.

	No. of lock.	Lift.	Elevation above Warrior River.	Distance between locks.		Curvature.			
				Feet.	Total feet.	100 to 200	200 to 300.	300 to 1,000.	1,000 to 4,000.
Dolomite road	32	11	327	3,800	48,800	......	......	1	1
	33	11	338	2,200	51,000	......	......	......	1
Possum Divide									
Ensley Furnaces									
Thomas Furnaces									
Village Creek									
Sloss Furnace	34	10	348	42,000	93,000	......	......	20	2
Railroads									
Neaves Ford, Five-mile Creek	......	......	....	30,000	123,000	......	......	1	6
Total, both divisions	......	......	....	....	325,000	......	......	......	......

The maximum traffic will be below Lock 6 on Valley River, as coal will form the largest single item in the canal shipments, and it will be mined and loaded all along the river division. The size of canal, 50 feet at water line and 6½ feet in depth, for the valley division has been taken at the minimum that would conform to the requirements of the act and accommodate a probable traffic for several years, the 6 inches depth more than draft being sufficient for possible speed attainable in the narrow channel and short distances between locks. The passing basins, which are 80 by 570 feet and located above each lock, are made 7 feet deep to allow for lowering of the small pools when filling locks and also to give the necessary slope to pass required amount of water through a canal having the proposed dimensions.

The estimates are for a prism in rock excavation 50 feet wide and 6½ feet deep, vertical sides being made by channeling along sides of canal. The cross-sectional area equals 325 square feet, or 2¼ times midship section of barge. The estimates for earth excavation are for a cross section 50 feet wide at water surface, with side slopes of 1½ to 1, making the bottom width 30½ feet for a depth of 6½ feet. To make the cross-sectional area of the earth equal to that of the rock, the earth section would have to be widened an additional 9 feet.

The passing of barges will have to be at the basins or in the rock sections. Passing basins below locks would facilitate operating purposes; also, loading and turning basins opposite furnaces, mills, etc., are necessary, but are not included in the estimates.

For the maximum traffic the size of the canal for this division should be at least three times the midship section of the barges, or 432 square feet, which would make the general dimensions for rock 65 by 65 by 7 feet and for earth section 75 by 56 by 7 feet, with at least 6 loading and turning basins; all of which would increase the estimates for this division by $700,000.

The estimates provide for 10 electric lights for each mile of canal and 2 at each lock; also telegraph and telephone lines.

There are 5 highway bridges; the estimates for replacing them with swing bridges are the same as those on the River division. There are also 3 fixed bridges, which are estimated at $1,750 each. For railway crossings at least 11 swing bridges will be required. Estimates are based for single-track bridges at the rate of $90 per foot.

The assessed valuation of the land along this division for 1897 was from $2 to $15 per acre, the latter being lots in subdivisions of North Birmingham. About one-twentieth of the land along the route is cultivated and the rest is timber land or rock barrens. The reservoir site and canal line from Five-mile Creek to North Birmingham belongs to the Birmingham Water Works Company. Filter beds will have to be made for the main system from the Cahaba River in the near future, so that the Five-mile Creek system will be less valuable than at present. Cost of latter system is given in the company's annual statement, published March 31, 1893.

Cost of water-works canal from Five-mile Creek, North Birmingham, from annual statement, March 31, 1893.

Water works investment		$99,995.08
Real estate	$138,574.79	
Right of way and water rights	9,715.57	
		148,290.36

Pumping station	$23, 651. 04	
Pumping machinery and boilers	43, 711. 64	
		$67, 362. 68
Canal	91, 134. 15	
Reservoirs	70, 325. 15	
Pump main	21, 576. 58	
		183, 035. 88
Total		498, 684. 00

Part of the lands are estimated on the same basis as those of the River division, at $5 per acre, and the remainder at $15 per acre.

Reservoir on Five-mile Creek.—Over ten years ago the water works company proposed building a dam for 50 feet depth of water on the site selected for the storage reservoir. A trench about 30 feet wide was excavated across the opening between the ridges. The greatest depth to bed rock was about 25 feet. The surface of the limestone rock in places was badly disintegrated, and near the center a crevice 12 to 15 feet wide and filled with decomposed and shattered rock crossed the trench at right angles. This was not cleaned out. About 1,000 feet below site of dam there is located the upper end of a cave in the limestone. Its entrance is 30 feet above the creek, and has a width of 10 feet and a height of 5 feet; its outlet is about 2 feet above low-water mark at Neaves Ford, one-fourth mile away.

In 1891 Mr. J. T. Fanning was employed as consulting engineer by the Birmingham Water Works Company. In his report of December, 1891, he states that "a storage reservoir can be built just above junction of Cedar Creek with Five mile Creek that will have about 67 acres surface and 200,000,000 gallons storage capacity. This will require a raising of the water surface so as to give it 30 feet depth at the dam, and this can undoubtedly be done with safety. The formation of the limestone substructure is such that there might be risks in raising the water to a greater height. This storage reservoir would have about 20 square miles watershed. This reservoir would have a head of about 20 feet of water above the upper end of the proposed 30-inch conduit in the bed of the present canal." * * *

The estimates are for a dam similar to the one on McAdory Creek, the crest length of this one being 990 feet. The cost of removing material for a depth of 20 feet from crevice and filling with concrete is included. The expense for any greater depth, or covering with clay or concrete any places in substructure developing leaks, is provided for in the amounts for contingencies. Two dolomite quarries are located 1 mile below the reservoir site and for a depth of 60 feet show thick ledges of solid limestone. About 500 feet above the dam a saddle in the west ridge is at the proposed elevation of the water surface and will permit the building of a spillway at least 200 feet long. It may be necessary to change the proposed sites for some of the reservoirs and lock dams after rock borings have been taken.

The certainty of a sufficient water supply for maintaining navigation the entire year in a canal from this district has often been questioned on account of the small visible stream flow during the dry season. For the River division it has been shown by the computations from the rainfall records for five years and the area of the watershed that the available supply is ample, and this has been corroborated with the gaugings of the river taken during the greatest known drought and those taken during the rainy season. To remove all doubt as to that division, estimates have been made for a supply feed canal from Five-mile Creek reservoir to loading basin at McAdory having a daily capacity of 5,000,000 cubic feet. From the reservoir to Possum Divide the grade of 0.6 foot per mile can be obtained.

With the velocity of 2 feet per second the most economical rectangular cross section in rock will be 6.2 feet deep and 12.4 feet wide for the wetted perimeter, estimates of excavation based on width of 12½ feet and depth of 6¼ feet. In earth with the side slopes of 1½ to 1 the dimensions will be 18.58 water surface, 3.1 bottom width, and 5.16 feet deep; estimates made for surface width of 19½, bottom width 3¼ and depth 5 feet. For this additional supply from Five-mile and Village creeks the cost will be $703,550, and is included in the supplemental estimate. The unit prices for excavation are increased over those for the barge canal, as the quantities are less and the work can not be done as advantageously.

The estimated time of transit through a canal for a single boat having a clear run is as follows:

	H.	M.	H.	M.
River division:				
38⅓ miles at 5 miles per hour	7	40		
21 locks at 15 minutes	5	15		
			12	55
Valley division:				
23⅓ miles at 4 miles per hour	5	50		
13 locks at 15 minutes	3	15		
			9	05
Total			22	00

For average rate during maximum traffic:

	H.	M.	H.	M.
River division:				
38¼ miles at 3 miles per hour	12	45		
21 locks at 30 minutes	10	30		
			23	15
Valley division:				
23⅓ miles at 2½ miles per hour	9	20		
13 locks at 30 minutes	6	30		
			15	50
Total			39	05

Two-thirds of the River division of down lockages will average three loaded barges and steamer carrying 1,800 tons, making the daily rate 28,800 tons, which would be increased to 31,680 tons if the up-bound freight be one-tenth of the down-bound. The annual commerce would be over 11,000,000 tons. On the same basis for 12 lockages per day on the Valley division the annual tonnage traffic will be 2½ million tons.

The annual cost of maintenance and operation of the canal is estimated at $60,000 for the Valley division and $90,000 for the River division.

The dam at Lock 21 will raise the water so as to flood 108 acres. The size of the pool, having a depth of 7 or more feet, will be 9,400 feet long, with varying widths of 300 to 500 feet. This will make a fine loading and turning basin, the dimensions being ample to permit of easy maneuvering of boats between docks and in turning around. Extending into Jones Valley it is easily accessible by highways and railroads, the Birmingham Mineral already skirting the southerly side. The estimates provide for facing the basin with timber cribs filled with stone, but a cheaper construction can be made by filling out to the harbor lines with hot slag from furnaces, and making the face vertical. The wharfage areas will be commodious enough for the best modern equipment for handling the various freights cheaply and expeditiously. This basin is also at the junction of the red and brown iron ores, the coal fields, the limestone, slates, and the chert gravel beds, all being within a distance of zero to 2 miles.

There is room in the adjacent valley for many furnaces and mills, the finished product from which can be loaded into barges from the tram cars.

The average rail haulage from the 25 furnaces in the district to the McAdory Basin is less than 13 miles. From the furnaces to the nearest points on the Valley division of canal the average distance is 3 miles, and then by canal to the McAdory Basin is 11 miles. The saving in cost of transportation for above distances on 2½ million tons of pig iron is $75,000 in favor of the Valley division. If the operation of this division cost $60,000 annually, then the actual saving would be only $15,000, which, capitalized at 3 per cent, represents $500,000. The estimated cost of the Valley division is over 3½ million dollars.

PRODUCTS AND TRANSPORTATION.

The Birmingham mineral district is a remarkable one for extent, quality, and proximity of its iron, coal, and limestone deposits. For a distance of 50 miles northeast and 25 miles southwest of Birmingham a vein of red fossiliferous ore of about 22 feet thick at the outcrop extends along the Red Mountains. In some of the mines slopes have been driven down at an angle of about 20 degrees for a distance of 1,000 feet and no change found in the ore either of quality or thickness. There are also extensive deposits of brown iron ore. The underlying formation of Jones Valley is limestone, containing extensive deposits of dolomite.

The Warrior, Cahaba, and Coosa coal fields comprise areas of 7,810, 400, and 345 square miles, respectively. The Warrior Measures have 53 seams of coal from a few inches to 14 feet thick, with a combined thickness for all of 100 feet, about one-fourth of which is within 300 feet of the surface. Eight seams of 4 or more feet in thickness have an average combined thickness of 40 feet. As the angle of dip is small, less than 22 degrees, the roofs solid, and the underlying bed soft, the mining only costs from 37½ to 40 cents per ton, and the coal is sold in the district for 75 cents to $1 per ton. There is every variety of bituminous coal, some excellent for coking, others for iron ore smelting, for heating, steaming, and all domestic purposes. The Valley River Canal would be tributary to 100 square miles of workable coal areas. At present the cost of ore per ton of 2,240 pounds at the furnace stock houses, including freight charges, is, for hard red, 75 cents, royalty added; soft red, 65 cents, royalty added, brown, $1, royalty added, the length of haul being from 2 to 15 miles; for coke, $1.75; haulage, 0 to 12 miles; for limestone and dolomite, 40 to 65 cents; haulage, 6 to 20 miles. The quantity of each mineral is inexhaustible for centuries.

The manufacturing plants have been principally established since 1880. In 1897 there were over 30 mines in operation in Jefferson County. The output was 5,900,000 tons, an increase from 380,000 tons in 1880. The product of the 3,845 coke ovens in the district was 1,500,000 tons, an increase from 60,781 tons in 1880. There are 25 furnaces in the district, each having a daily capacity of 180 to 250 tons of pig iron. The product for 1897 was 799,064 tons, an increase from 68,925 tons in 1880. Grades of pig iron are mill, foundry, and basic iron. The basic iron is suitable for making the best qualities of steel. Two open-hearth furnaces, with a daily capacity of 160 tons of basic steel, have been in operation since July, 1897. The largest pipe works in the United States are located at Bessemer. The cotton receipts at Birmingham during the past season was nearly 150,000 bales.

The freight traffic through the canal will be principally coal, pig and manufactured iron, chert gravel, and cotton, all down bound, and will probably amount to 2,000,000 tons the first year after opening the canal, and then rapidly increase to the limit of 11,000,000 tons.

There are seven trunk lines of railroad centering in Birmingham, which have 600 miles of track in Jefferson County. The nearest seaports are those of Pensacola, Fla., and Mobile, Ala., which are distant 259 and 278 miles by railroad.

The average freight rate on all railroads in the United States for 1896 was 8.21 mills per ton per mile. The average trunk-line rate on heavy through freight is from 5 to 6 mills. In Pennsylvania the average rate for freight from Pittsburg to Lake Erie ports is 6.7 mills per ton per mile. Where the railroad conditions are so favorable as are those from Birmingham to the Gulf of Mexico as to grades, rock foundation for roadbeds, and entire freedom from snow, the rail ton mile on coal and iron can be a paying one at 4 mills.

The coal transportation from Pittsburg to New Orleans by river is remunerative at one-third of a mill per ton mile.

The rate for all freight passing through St. Marys Falls Canal, including loading and unloading at terminals, has averaged about 1 mill per ton per mile for several years.

The ton-mile rate on the canal and rivers from Birmingham to Mobile ought not to exceed 1 mill.

To provide a cheap means of transportation to the sea for the heavy products of this district there are four possible outlets. All are based on the assumption that the project for a navigation of 6 feet draft on the Warrior and Tombigbee rivers will be duly completed.

	Distances—	
	By rail.	By water.
	Miles.	*Miles.*
1. From Birmingham to Tuscaloosa	57	
From Tuscaloosa to Demopolis		130
From Demopolis to Mobile		230
Total	57	360
2. From Birmingham to mouth of Valley River	26	
From Valley River to Tuscaloosa		44
From Tuscaloosa to Mobile		360
Total	26	404
3. From Furnaces to Locust Fork, Kansas City crossing	22	
Kansas City crossing to Tuscaloosa		70
Tuscaloosa to Mobile		360
Total	22	430
4. From Furnaces to McAdory loading basin	13	
From loading basin to mouth of Valley River		38
From Valley River to Tuscaloosa		44
From Tuscaloosa to Mobile		360
Total	13	442

The cost of transportation of 1 ton of pig iron to Mobile by the above routes at the mile rate of 4 mills by rail and 1 mill by water, together with the amount saved on 1,000,000 tons by each route over that of the all-rail route, is as follows:

	Rail rate.	Water rate.	Amount saved on 1,000,000 tons.
All rail	$1.11		
Route 1	23	$0.36	$520,000
Route 2	10	41	600,000
Route 3	9	43	590,000
Route 4	5	44	620,000

For route 4 the cost of loading into barges will be less than for the others, as the McAdory basin is easier of access and has but little variation in height of water surface.

On coal, the rail haulage for route 1 would be increased by several miles through a hilly country where alignment and grades of road would increase freight rates; for route 3, the rail distance would be less; for route 4, the coal can be loaded into barges all along Valley River, while the rail distance from present mines would be less than that for pig iron from the present furnaces. On cotton, route 4 is the most favorable one. On chert gravel, no rail haulage will be necessary for route 4, the cost of rail transportation on this material being almost prohibitive. The saving by route 2 will be more than by route 3, and cost of improvements will be less. The coal areas benefited by routes 2, 3, and 4 would be about the same.

The rail shipments on route 4 to McAdory would be practically all down grade, while on route 3 there are many up grades and sharp curves between Birmingham and the Kansas City crossing of the Locust Fork at Warrior River. The Valley River Canal will better serve the interest of the Birmingham district by nearly $300,000 on ten millions of freight than the route to Locust Fork. The other factor would be the relative cost of the two routes in determining which improvement to make first. Undoubtedly the interests of the district will eventually warrant both improvements. A survey of the Locust Fork has not yet been made. For a commerce of 10,000,000 tons the ratio of savings for the several routes over that of the all-rail one will be relatively more favorable for route 4 than it was for iron shipments alone. If the cost of building one or more tracks from a central point in the district to Tuscaloosa, mouth of Valley River, Locust Fork, or McAdory loading basin be considered, in addition to the cost of the river improvements for the respective routes, then route 4, via Valley River, will be the cheapest one.

CONCLUSIONS.

The detailed discussions in this report show that the canalization of Valley River and the excavation of a canal up the valley past Birmingham is feasible, and that the water supply for the Valley division is insufficient, and that the saving on transportation of probable commerce will not warrant the expenditure of $3,000,000 or $4,000,000 for that division.

That the water supply for the River division is ample; that a reservoir on McAdory Creek is necessary, and that with 50 feet head of water it will be large enough to supply over 4,000,000 cubic feet daily, which will maintain two-thirds of the maximum traffic of 48 lockages daily during an extreme drought of ninety days; that when the traffic approaches that limit the capacity of the reservoir can be increased so as to supply 6,000,000 cubic feet daily by building a second dam for 30 feet head of water.

That if the requirements were such as to demand an additional supply of water, a feeder canal can be built for $750,000 to Five-mile Creek, having a daily capacity of 5,000,000 cubic feet, fifty days' supply being the storage capacity of reservoir.

That the expenditure of $3,750,000 for canalizing Valley River is fully warranted by the assured and prospective shipments from the district. The betterment of these transportation facilities will be far-reaching in the economies of the United States.

Very respectfully, your obedient servant,

Joseph Ripley,
Assistant Engineer.

Maj. Wm. T. Rossell,
Corps of Engineers, United States Army.

Detailed estimates of cost of proposed Birmingham Canal.

RIVER DIVISION.

	Quantity.	Unit price.	Cost.
Warrior River to Lock No. 1:			
Right of way, 300 by 7,800 feet .... acres..	53.7	$5.00	$269
Lock site .... do....	20	5.00	100
Clearing and grubbing	....	....	200
Rock excavation (shoals) .... cubic yards..	3,700	2.00	7,400
Total	....	....	7,969

Detailed estimates of cost of proposed Birmingham Canal—Continued.

RIVER DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Warrior River to Lock No. 1—Continued.			
Lock and abutment:			
Concrete, cubic yards	11,400	$6.50	$74,100
Earth excavation, do	3,500	.25	875
Rock excavation, do	2,500	1.00	2,500
Earth fill, do	7,500	.30	2,250
Paving, square yards	7,000	1.00	7,000
Gates and valves			10,000
Cofferdam and pumping			5,000
Total			101,725
Guide crib, 28 feet 8 inches by 11 feet 6 inches by 90 feet:			
Lumber and iron, M feet B. M.	33.5	14.00	469
Framing, do	33.5	12.65	424
Rock filling, cubic yards	1,100	.35	385
Total			1,278
Dam, 80 feet long, 34 feet wide at base, 16 feet high:			
Lumber and iron, M feet B. M.	12	14.00	168
Framing, do	12	7.50	90
Masonry, dry rubble, cubic yards	750	2.25	1,688
Concrete, do	260	6.50	1,690
Filling above dam, do	200	.60	120
Total			3,756
Office and keeper's dwelling			2,500
Aggregate			117,228
Lock No. 1 to Lock No. 2:			
Right of way, 300 by 10,000 feet, acres	68.8	5.00	344
Lock site, do	20	5.00	100
Clearing and grubbing			300
Lock and abutment, same as No. 1			101,725
Guide crib, same as No. 1			1,278
Dam, 80 feet long			3,756
Office and keeper's dwelling			2,500
Total			110,003
Lock No. 2 to Lock No. 3:			
Right of way, 300 by 7,000 feet, acres	48.2	5.00	241
Lock site, do	20	5.00	100
Clearing and grubbing			300
Loose rock in channel, cubic yards	400	1.00	400
Lock and abutment same as No. 1			101,725
Guide crib same as No. 1			1,278
Dam, 200 feet long			9,389
Office and keeper's dwelling			2,500
Total			115,923
Lock No. 3 to Lock No. 4:			
Right of way, 300 by 8,000 feet, acres	55.1	5.00	275
Lock site, do	20	5.00	100
Clearing and grubbing			570
Lock and abutment same as No. 1			101,725
Guide crib same as No. 1			1,278
Dam, 130 feet long			6,103
Office and keeper's dwelling			2,500
Total			112,551
Lock No. 4 to Lock No. 5:			
Right of way, 300 by 5,000 feet, acres	34.4	5.00	172
Lock site, do	20	5.00	100
Clearing and grubbing			465
Lock and abutment same as No. 1			101,725
Guide crib same as No. 1			1,278
Dam, 160 feet long			7,511
Office and keeper's dwelling			2,500
Total			113,751

Detailed estimates of cost of proposed Birmingham Canal—Continued.

RIVER DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Lock No. 5 to Lock No. 6:			
Right of way, 300 by 18,000 feet ... acres	124	$5.00	$620
Lock site ... do	20	5.00	100
Clearing and grubbing			600
Lock and abutment			101,725
Guide crib			1,278
Dam, 100 feet long			4,694
Office and keeper's dwelling			2,500
Total			111,517
Lock No. 6 to Lock No. 7:			
Right of way, 300 by 6,200 feet ... acres	42.7	5.00	214
Lock site ... do	20	5.00	100
Clearing and grubbing			200
Lock and abutment			101,725
Guide crib			1,278
Dam, 100 feet long			4,694
Office and keeper's dwelling			2,500
Total			110,711
Lock No. 7 to Lock No. 8:			
Lock site ... acres	20	5.00	100
Right of way, 300 by 16,800 feet ... do	115.7	5.00	578
Clearing and grubbing			630
Lock and abutment			101,725
Guide crib			1,278
Dam, 60 feet long			2,817
Office and keeper's dwelling			2,500
Total			109,628
Lock No. 8 to Lock No. 9:			
Right of way, 300 by 6,500 feet ... acres	44.7	5.00	224
Lock site ... do	20	5.00	100
Clearing and grubbing			265
Lock and abutment			101,725
Guide crib			1,278
Dam, 115 feet long			5,398
Office and keeper's dwelling			2,500
Total			111,490
Lock No. 9 to Lock No. 10:			
Right of way, 300 by 15,500 feet ... acres	106.7	5.00	534
Lock site ... do	20	5.00	100
Clearing and grubbing			500
Lock and abutment			101,725
Guide crib			1,278
Dam, 65 feet long			3,051
Office and keeper's dwelling			2,500
Total			109,688
Lock No. 10 to Lock No. 11:			
Right of way, 300 by 10,500 feet ... acres	72.3	5.00	362
Lock site ... do	20	5.00	100
Clearing and grubbing			570
One swing highway bridge ... feet	200	50.00	10,000
Lock and abutment			101,725
Guide crib			1,278
Dam, 65 feet long			3,051
Office and keeper's dwelling			2,500
Total			119,586
Lock No. 11 to Lock No. 12:			
Right of way, 300 by 13,500 feet ... acres	92.9	5.00	465
Lock site ... do	20	5.00	100
Clearing and grubbing			800
Lock and abutment			101,725
Guide crib			1,278
Dam, 90 feet long			4,225
Office and keeper's dwelling			2,500
Total			111,093

Detailed estimates of cost of proposed Birmingham Canal—Continued.

RIVER DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Lock No. 12 to Lock No. 13:			
Right of way, 300 by 15,500 feet, acres	106.7	$5.00	$534
Lock site, do.	20	5.00	100
Clearing and grubbing			775
Lock and abutment			101,725
Guide crib			1,278
Dam, 60 feet long			2,817
Office and keeper's dwelling			2,500
Total			109,729
Lock No. 13 to Lock No. 14:			
Right of way, 300 by 5,700 feet, acres	39.2	5.00	196
Lock site, do.	20	5.00	100
Clearing and grubbing			375
Lock and abutment			101,725
Guide crib			1,278
Dam, 150 feet long			7,042
Office and keeper's dwelling			2,500
Total			113,216
Lock No. 14 to Lock No. 15:			
Right of way, 300 by 6,800 feet, acres	46.8	5.00	234
Lock site, do.	20	5.00	100
Clearing and grubbing			535
Lock and abutment			101,725
Guide crib			1,278
Dam, 70 feet long			3,286
Office and keeper's dwelling			2,500
Total			109,658
Lock No. 15 to Lock No. 16:			
Right of way, 300 by 4,500 feet, acres	31	5.00	155
Lock site, do.	20	5.00	100
Clearing and grubbing			500
Lock and abutment			101,725
Guide crib			1,278
Dam, 100 feet long			4,694
Office and keeper's dwelling			2,500
Total			110,952
Lock No. 16 to Lock No. 17:			
Right of way, 300 by 4,300 feet, acres	29.6	5.00	148
Lock site, do.	20	5.00	100
Clearing and grubbing			465
Excavation, loose rock, cubic yards	3,000	1.00	3,000
Lock and abutment			101,725
Guide crib			1,278
Dam, 140 feet long			6,572
Office and keeper's dwelling			2,500
Total			112,075
Big Blue Creek Reservoir Dam:			
Reservoir site, acres	50	5.00	250
Concrete, cubic yards	400	6.50	2,600
Clay puddle, do.	1,300	.75	975
Earth excavation, do.	200	.25	50
Earth fill, do.	1,000	.50	500
Rock fill, do.	1,200	2.00	2,400
Paving, square yards	1,000	1.00	1,000
Sluiceway and gates			5,000
Total			12,775
Lock No. 17 to Lock No. 18:			
Right of way, 300 by 6,200 feet, acres	42.7	5.00	214
Lock site, do.	20	5.00	100
Clearing and grubbing			535
Lock and abutment			101,725
Guide crib			1,278
Dam, 90 feet long			4,225
Office and keeper's dwelling			2,500
Total			110,577

Detailed estimates of cost of proposed Birmingham Canal—Continued.

RIVER DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Lock No. 18 to Lock No. 19:			
Right of way, 300 by 7,200 feet .... acres..	49.6	$5.00	$248
Lock site .... do....	20	5.00	100
Clearing and grubbing			570
One swinging highway bridge .... feet..	200	50.00	10,000
Lock and abutment			101,725
Guide crib			1,278
Dam, 100 feet long			4,694
Office and keeper's dwelling			2,500
Total			121,115
Lock No. 19 to Lock No. 20:			
Right of way, 300 by 10,600 feet .... acres..	73	5.00	365
Lock site .... do....	20	5.00	100
Clearing and grubbing			665
Earth excavation (lock approach) .... cubic yards..	2,000	.35	700
Lock and abutment			101,725
Guide crib			1,278
Dam, 160 feet long			7,511
Office and keeper's dwelling			2,500
Total			114,844
Little Blue Creek Reservoir Dam:			
Reservoir site .... acres..	100	5.00	500
Concrete .... cubic yards..	1,050	6.50	6,825
Clay puddle .... do....	3,400	.75	2,550
Earth fill .... do....	6,400	.50	3,200
Rock fill .... do....	8,000	2.00	1,600
Paving .... square yards..	1,000	1.00	1,000
Earth excavation .... cubic yards..	250	.25	63
Sluiceway and gates			5,000
Total			20,738
Lock No. 20 to Lock No. 21:			
Right of way, 300 by 7,300 feet .... acres..	50.3	5.00	252
Lock site .... do....	20	5.00	100
Clearing and grubbing			535
Lock and abutment			101,725
Guide crib			1,278
Dam, 100 feet long			4,696
Office and keeper's dwelling			2,500
Total			111,086
Lock No. 21 to upper end of loading basin:			
Piers, 2 miles			100,000
Right of way and site .... acres..	150	5.00	750
Clearing and grubbing			1,000
Total			101,750
McAdory reservoir and dam, 50 feet head:			
Land for site .... acres..	600	5.00	3,000
Earth excavation .... cubic yards..	1,000	.25	250
Concrete .... do....	7,500	6.50	48,750
Clay puddle .... do....	25,000	.75	18,750
Earth fill .... do....	300,000	.50	150,000
Paving .... square yards..	22,000	1.00	22,000
Spillway over side divide			5,000
Sluiceways and gates			25,000
Total			272,750
Miscellaneous:			
Snubbing posts along canal .... miles..	40	200.00	8,000
Electric lights, telegraph, and telephone .... do....	40	2,000.00	80,000
Main line of railroad .... do....	25	10,000.00	250,000
Spurs to lock sites .... do....	10	2,000.00	20,000
Water-power mills	5	1,000.00	5,000
Total			363,000

Detailed estimates of cost of proposed Birmingham Canal—Continued.

RIVER DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Supplemental—Conditional on water supply required.			
Reservoir Dam No. 2 at McAdory Creek, 30 feet head:			
Reservoir site .... acres..	600	$5.00	$3,000
Earth excavation .... cubic yards..	1,000	.25	250
Concrete .... do....	4,480	6.50	29,120
Clay puddle .... do....	14,950	.75	11,213
Earth fill .... do....	140,000	.50	70,000
Paving .... square yards..	15,000	1.00	15,000
Gates and sluiceways			25,000
Engineering and contingencies, 20 per cent			30,717
Total			184,300
Feeder canal.			
From reservoir at Five-mile Creek to loading basin at McAdory:			
Right of way, 300 by 42,000 feet .... acres..	289	15.00	4,335
Right of way, 300 by 81,000 feet .... do....	558	5.00	2,790
Rock excavation .... cubic yards..	255,400	.75	191,550
Earth excavation .... do....	104,900	.18	18,882
Rock fill in embankment .... do....	4,800	2.00	9,600
Masonry lining in embankment .... do....	3,450	8.00	27,600
Highway bridges (8) .... feet..	160	10.00	1,600
Highway bridges (3) .... do....	120	12.50	1,500
Railway bridges (10) .... do....	200	30.00	6,000
Reservoir and dam, Five-mile Creek			313,725
Telephone .... miles..	25	175.00	4,375
Engineering and contingencies, 20 per cent			116,391
Total			698,348

SUMMARY OF ESTIMATE—RIVER DIVISION.

Warrior River to Lock No. 1	$117,228
Lock No. 1 to Lock No. 2	110,003
Lock No. 2 to Lock No. 3	115,933
Lock No. 3 to Lock No. 4	112,551
Lock No. 4 to Lock No. 5	113,751
Lock No. 5 to Lock No. 6	111,517
Lock No. 6 to Lock No. 7	110,711
Lock No. 7 to Lock No. 8	109,628
Lock No. 8 to Lock No. 9	111,490
Lock No. 9 to Lock No. 10	109,668
Lock No. 10 to Lock No. 11	119,586
Lock No. 11 to Lock No. 12	111,093
Lock No. 12 to Lock No. 13	109,739
Lock No. 13 to Lock No. 14	113,216
Lock No. 14 to Lock No. 15	109,658
Lock No. 15 to Lock No. 16	110,952
Lock No. 16 to Lock No. 17	112,075
Big Blue Creek Reservoir Dam	12,775
Lock No. 17 to Lock No. 18	110,577
Lock No. 18 to Lock No. 19	121,115
Lock No. 19 to Lock No. 20	114,844
Little Blue Creek Reservoir Dam	20,738
Lock No. 20 to Lock No. 21	111,086
Lock No. 21 to upper end of loading basin	101,750
McAdory Reservoir and Dam, 50-foot head	272,750
Miscellaneous	363,000
	3,137,444
Engineering and contingencies, 20 per cent	627,489
Total	3,764,933

Detailed estimates of cost of proposed Birmingham Canal—Continued.

VALLEY DIVISION.

[NOTE.—Each stretch includes the lock and passing basin at the upper end of the lock.]

	Quantity.	Unit price.	Cost.
Upper end of loading basin to Lock No. 22:			
Right of way, 300 by 2,000 feet ... acres	13.8	$5.00	$69
Lock site ... do	10	5.00	50
Rock excavation ... cubic yards	9,000	.65	5,850
Clearing and grubbing			300
Rock excavation (lock pit, Lock No. 22) ... cubic yards	20,500	.65	13,325
Concrete ... do	6,500	6.50	42,250
Back fill ... do	3,900	.25	975
Paving ... square yards	200	1.00	200
Gates and valves			10,000
Cofferdam and pumping			5,000
Office and keeper's dwelling			2,500
Rock excavation in basin ... cubic yards	9,800	.65	6,370
Total			86,889
Lock No. 22 to Lock No. 23:			
Right of way, 300 by 5,000 feet ... acres	34.4	5.00	172
Lock site ... do	10	5.00	50
Rock excavation ... cubic yards	70,600	.65	45,890
Clearing and grubbing			400
Rock excavation (lock pit, Lock No. 23) ... cubic yards	17,800	.65	11,570
Concrete ... do	6,500	6.50	42,250
Back fill ... do	3,900	.25	975
Paving ... square yards	200	1.00	200
Gates and valves			10,000
Cofferdam and pumping			5,000
Office and keeper's dwelling			2,500
Rock excavation in basin ... cubic yards	7,600	.65	4,940
Embankment ... do	4,900	.35	1,715
Total			125,662
Lock No. 23 to Lock No. 24:			
Right of way, 300 by 4,000 feet ... acres	27.5	5.00	138
Lock site ... do	10	5.00	50
Rock excavation (canal) ... cubic yards	38,000	.65	24,700
Embankment (canal) ... do	7,800	.35	2,730
Clearing and grubbing			100
Rock excavation (lock pit, Lock No. 24) ... cubic yards	16,700	.65	10,855
Concrete ... do	6,500	6.50	42,250
Back fill ... do	3,900	.25	975
Paving ... square yards	200	1.00	200
Gates and valves			10,000
Cofferdam and pumping			5,000
Office and keeper's dwelling			2,500
Rock excavation in basin ... cubic yards	7,600	.65	4,940
Embankment ... do	4,900	.35	1,715
Total			106,153
Lock No. 24 to Lock No. 25:			
Right of way, 300 by 11,300 feet ... acres	78	5.00	390
Lock site ... do	10	5.00	50
Clearing and grubbing			200
Rock excavation ... cubic yards	121,600	.65	79,040
Embankment ... do	62,100	.35	21,735
2 railway swing bridges, 130-foot span ... feet	260	90.00	23,400
1 highway bridge fixed, 70-foot span ... do	70	25.00	1,750
Rock excavation (lock pit, Lock No. 25) ... cubic yards	18,800	.65	12,220
Concrete ... do	6,500	6.50	42,250
Back fill ... do	3,900	.25	975
Paving ... square yards	200	1.00	200
Gates and valves			10,000
Cofferdam and pumping			5,000
Office and keeper's dwelling			2,500
Rock excavation in basin ... cubic yards	10,900	.65	7,085
Total			206,795
Lock No. 25 to Lock No. 26:			
Right of way, 300 by 5,700 feet ... acres	39.2	5.00	196
Lock site ... do	10	5.00	50
Clearing and grubbing			400
Rock excavation (lock pit, Lock No. 26) ... cubic yards	17,500	.65	11,375
Embankment ... do	23,900	.35	8,365
Rock excavation ... do	52,800	.65	34,320
Concrete ... do	6,500	6.50	42,250

Detailed estimates of cost of proposed Birmingham Canal—Continued.

VALLEY DIVISION—Continued.

		Quantity.	Unit price.	Cost.
Lock No. 25 to Lock No. 26—Continued.				
Back fill	cubic yards	3,900	$0.25	$975
Paving	square yards	200	1.00	200
Gates and valves				10,000
Cofferdam and pumping				5,000
Office and keeper's dwelling				2,500
Rock excavation in basin	cubic yards	6,300	.65	4,095
Embankment	do	5,500	.35	1,925
Total				121,651
Lock No. 26 to Lock No. 27:				
Right of way, 300 by 4,500 feet	acres	31	5.00	155
Lock site	do	10	5.00	50
Clearing and grubbing				400
Rock excavation	cubic yards	55,600	.65	36,140
Embankment	do	10,300	.35	3,605
One railway swing bridge	feet	130	90.00	11,700
Rock excavation, lock pit	cubic yards	20,700	.65	13,455
Concrete	do	6,500	6.50	42,250
Back fill	do	3,900	.25	975
Paving	square yards	200	1.00	200
Gates and valves				10,000
Cofferdam and pumping				5,000
Office and keeper's dwelling				2,500
Rock excavation in basin	cubic yards	14,400	.65	9,360
Total				135,790
Lock No. 27 to Lock No. 28:				
Right of way, 300 by 3,500 feet	acres	24	5.00	120
Lock site	do	10	5.00	50
Clearing and grubbing				300
Rock excavation	cubic yards	57,300	.65	37,245
Rock excavation, lock pit	do	25,400	.65	16,510
Concrete	do	6,500	6.50	42,250
Back fill	do	3,900	.25	975
Paving	square yards	200	1.00	200
Gates and valves				10,000
Cofferdam and pumping				5,000
Office and keeper's dwelling				2,500
Rock excavation in basin	cubic yards	22,000	.65	14,300
Total				129,450
Lock No. 28 to Lock No. 29:				
Right of way, 300 by 3,000 feet	acres	20.6	5.00	103
Lock site	do	10	5.00	50
Clearing and grubbing				200
Rock excavation	cubic yards	46,700	.65	30,355
Rock excavation, lock pit	do	19,700	.65	12,805
Concrete	do	6,500	6.50	42,250
Back fill	do	3,900	.25	975
Paving	square yards	200	1.00	200
Gates and valves				10,000
Cofferdam and pumping				5,000
Office and keeper's dwelling				2,500
Rock excavation in basin	cubic yards	8,400	.65	5,460
Embankment	do	4,300	.35	1,505
Total				111,403
Lock No. 29 to Lock No. 30:				
Right of way, 300 by 3,000 feet	acres	20.6	5.00	103
Lock site	do	10	5.00	50
Clearing and grubbing				200
Rock excavation	cubic yards	41,700	.65	27,105
Fixed highway bridge, 70-foot span	feet	70	25.00	1,750
Rock excavation, lock pit	cubic yards	21,000	.65	13,650
Concrete	do	6,500	6.50	42,250
Back fill	do	3,900	.25	975
Paving	square yards	200	1.00	200
Gates and valves				10,000
Office and keeper's dwelling				2,500
Rock excavation in basin	cubic yards	13,500	.65	8,775
Total				107,558

Detailed estimates of cost of proposed Birmingham Canal—Continued.

VALLEY DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Lock No. 30 to Lock No. 31:			
Right of way, 300 by 3,000 feet ... acres..	20.6	$5.00	$103
Lock site ... do....	10	5.00	50
Clearing and grubbing			200
Rock excavation ... cubic yards..	20,400	.65	13,260
Earth excavation ... do....	23,600	.15	3,540
Earth excavation, lock pit ... do....	24,500	.15	8,675
Concrete ... do....	6,500	6.50	42,250
Back fill ... do....	15,800	.25	3,950
Paving ... square yards..	400	1.00	400
Office and keeper's dwelling			2,500
Gates and valves			10,000
Earth excavation in basin ... cubic yards..	7,800	.15	1,170
Crib work ... feet..	570	10.00	5,700
Paving ... square yards..	1,000	1.00	1,000
Total			87,798
Lock No. 31 to Lock No. 32:			
Right of way, 300 by 3,800 feet ... acres..	26	5.00	130
Lock site ... do....	10	5.00	50
Clearing and grubbing			100
Earth excavation ... cubic yards.	55,900	.15	8,385
One-swing highway bridge ... feet..	130	50.00	6,500
Earth excavation, lock pit ... cubic yards..	38,300	.15	5,745
Concrete ... do....	6,500	6.50	42,250
Back fill ... do....	15,800	.25	3,950
Paving ... square yards..	400	1.00	400
Gates and valves			10,000
Office and keeper's dwelling			2,500
Earth excavation in basin ... cubic yards..	17,600	.15	2,640
Piers ... feet..	570	10.00	5,700
Paving ... square yards..	1,000	1.00	1,000
Total			89,350
Lock No. 32 to Lock No. 33:			
Right of way, 300 by 2,200 feet ... acres..	15	15.00	225
Lock site ... do....	10	15.00	150
Clearing and grubbing			100
Earth excavation ... cubic yards..	28,400	.15	4,260
Earth excavation, lock pit ... do....	34,000	.15	5,100
Concrete ... do....	6,500	6.50	42,250
Back fill ... do....	15,800	.25	3,950
Paving ... square yards..	400	1.00	400
Gates and valves			10,000
Office and keeper's dwelling			2,500
Earth excavation in basin ... cubic yards..	14,700	.15	2,205
Piers ... feet..	570	10.00	5,700
Paving ... square yards..	1,000	1.00	1,000
Total			77,840
Lock No. 33 to Lock No. 34:			
Right of way, 300 by 42,000 feet ... acres..	289	15.00	4,335
Lock site ... do....	10	15.00	150
Clearing and grubbing			2,500
Earth excavation ... cubic yards..	271,100	.15	40,665
Rock excavation ... do....	239,100	.65	155,415
Embankment ... do....	126,600	.35	44,310
Spillway			5,000
Three railway swing bridges ... feet..	390	90.00	35,100
Six highway swing bridges ... do....	780	50.00	39,000
Rock excavation, lock pit ... cubic yards..	19,100	.65	12,415
Concrete ... do....	6,500	6.50	42,250
Back fill ... do....	3,900	.25	975
Paving ... square yards..	200	1.00	200
Gates and valves			10,000
Cofferdam and pumping			5,000
Office and keeper's dwelling			2,500
Rock excavation in basin ... cubic yards..	20,300	.65	13,195
Total			413,010

Detailed estimates of cost of proposed Birmingham Canal—Continued.

VALLEY DIVISION—Continued.

	Quantity.	Unit price.	Cost.
Lock No. 34 to Reservoir Dam:			
Right of way, 300 by 30,000 feet ... acres	207	$15.00	$3,105
Clearing and grubbing			500
Rock excavation ... cubic yards	703,500	.65	457,275
Embankment ... do	27,700	.35	9,695
Four railway swing bridges ... feet	520	90.00	46,800
Two highway fixed bridges ... do	140	25.00	3,500
Spillway			5,000
Total			526,910
Reservoir Dam on Five-mile Creek:			
Reservoir site ... acres	300	5.00	1,500
Earth excavation ... cubic yards	9,700	.25	2,425
Concrete ... do	9,400	6.50	61,100
Clay puddle ... do	31,200	.75	23,400
Earth fill ... do	345,600	.50	172,800
Paving ... square yards	21,000	1.00	21,000
Gates and sluiceways			25,000
Paving for side spillway ... square yards	4,000	1.00	4,000
Office and keeper's dwelling			2,500
Total			313,725
Miscellaneous:			
Snubbing posts ... miles	23¼	200.00	4,650
Electric lights, telegraph and telephone ... do	23¼	2,000.00	46,500
Three keeper's dwellings at spillways			7,500
Railway sidings for lock sites ... miles	10	2,000.00	20,000
Total			78,650

SUMMARY OF ESTIMATE—VALLEY DIVISION.

Upper end of loading basin to Lock No. 22	$86,889
Lock No. 22 to Lock No. 23	125,662
Lock No. 23 to Lock No. 24	106,153
Lock No. 24 to Lock No. 25	206,795
Lock No. 25 to Lock No. 26	121,651
Lock No. 26 to Lock No. 27	135,790
Lock No. 27 to Lock No. 28	129,450
Lock No. 28 to Lock No. 29	111,403
Lock No. 29 to Lock No. 30	107,558
Lock No. 30 to Lock No. 31	87,798
Lock No. 31 to Lock No. 32	89,350
Lock No. 32 to Lock No. 33	77,840
Lock No. 33 to Lock No. 34	413,010
Lock No. 34 to reservoir dam	526,910
Reservoir dam on Five-mile Creek	313,725
Miscellaneous	78,650
	2,718,634
Engineering and contingencies, 20 per cent	543,727
Total	3,272,361

DESCRIPTION OF BENCH MARKS, TOPOGRAPHICAL SURVEY OF PROPOSED BIRMINGHAM CANAL, 1897.

[The letters U. S. B. M. and number of bench mark are either cut in rock or marked on blazed trees. Elevations depend on the field reduction of precise level notes, and are referred to mean low water at Mobile, which is 1.255 feet below average Gulf level at Biloxi, Miss., as determined by the United States Coast and Geodetic Survey.]

Description.	Feet above mean low water at Mobile, Ala.
6. Top of spike on post oak 12 inches in diameter, about one-half mile west of mill on Five-mile Creek, 50 feet back of station 23 E and 30 feet left of traverse line up the creek	634.953
5. Spike, sycamore tree, 6 inches, on east bank of Five-mile Creek, about 3,000 feet above junction with Dry Branch, 110 feet northeast of △ 15 E and 5 feet left of line	594.153
4. Spike, oak tree, 10 inches, about 800 feet south of small church and 200 feet east of negro cabin, both on road up Dry Branch Valley, 10 feet right of △ 26 E	630.898
3. Spike, post oak, 18 inches, is 8 feet left of line up Dry Branch and 100 feet back of △ 17 E.	622.668
2. Spike, oak, 5 inches, is 10 feet left of line up Dry Branch and 60 feet beyond △ 11 E	593.453
B. Square on coping of masonry, Birmingham Waterworks Canal, near south end of pipe line in reservoir site on Five-mile Creek, and 150 feet west of watchman's house	578.813
1. Spike, chestnut, 10 inches, on summit at junction of two roads leading from Huntsville pike to Cold Springs through reservoir site, 770 feet north of traverse line and 570 feet beyond △ 6 E	623.608
A. Square on limestone ledge, about 3,000 feet north of Neaves Ford on Five-mile Creek; 5 feet east of Huntsville road and 92 feet south of △ 4 E. Witness tree, chestnut oak, 6 inches, east 3 feet	572.928
Cave. Square on limestone ledge, 9 feet north of mouth of cave, and 250 feet east of Neaves Ford at intersection of Huntsville road and Five-mile Creek	552.973
101. Spike, black oak, 12 inches, southeast side of Huntsville road, one-half mile southwest of Neaves Ford, and 7 feet northwest of △ 3 S. Black oak, 9 inches, northeast 32 feet; Birmingham Waterworks Canal 44 feet southeast	572.548
102. Spike, sweet gum, 12 inches, on easterly side of Huntsville road, 400 feet north of Dolcito crossing. J. H. Goodman's house 63 feet southeast; △ 4 north 185 feet	551.283
103. Spike, china berry, 30 feet west of center of Huntsville road; Green homestead northeast 69 feet; china berry, 18 inches, north 14 feet; cedar, 12 inches, south 42 feet; △ 6 S southwest 272 feet	548.873
A 1. Square on north edge limestone ledge, outcrop 6 by 12 feet and 4 feet above ground, under three large elms on west side Huntsville road. Beech, west 38 feet; store, south 126 feet; fence corner, east 95 feet	543.323
B 1. Square on limestone ledge 3 feet by 18 feet and one-half foot above ground; 18 feet west of Louisville and Nashville R. R. and 180 feet north of Huntsville road; △ 9 S south 250 feet	549.738
C 1. Square on north end of limestone outcrop 5 by 40 feet, and is 40 feet southeast of crossing of Louisville and Nashville and the Mary Lee R. Rs. with the Huntsville road. Pine northeast 34 feet; △ 12 southwest 34 feet; center of Huntsville road east 12 feet	566.878
Bridge. Square on southwest masonry abutment of the Louisville and Nashville R. R. bridge at Five-mile Creek crossing	534.813
104. Spike, white oak, 20 inches, in front of Thomas homestead, 18 feet northwest of center of Huntsville road; △ 14 S northeast 18 feet	574.913
105. Spike, oak, 10 inches, 50 feet west of North Birmingham R. R., at south end of cut at overhead crossing of Twenty-fourth street	628.613
U. S. P. B. M. 3. Top of ½-inch copper bolt leaded into stone step on north side of west entrance to post-office building in Birmingham. This permanent bench mark was established by precise level party Oct. 1, 1897	593.838
H 1. Square on limestone ledge 90 feet west of Stouts Road Bridge and 65 feet northerly of Village Creek, 200 feet west of △ 26 S; ash northerly 20 feet; gum westerly 10 feet; elm southeast 21 feet	551.408
I 1. Square on limestone ledge 77 feet west of old Stouts road and 88 feet northeast of △ 31 S. Three small oaks easterly 5 feet; locust southwest 25 feet	553.108
106. Spike, water oak, 18 inches, 40 feet north of △ 33 S, and east of north and south section line between secs. 26 and 27, T. 17 S. of R. 3 W. Sweet gum east 17 feet	545.428
J 1. Square on limestone ledge 200 feet south of traverse line between △ 35 S and △ 36 S. Large oak southeast 35 feet; large gum southwest 42 feet; small gum north 12 feet.	541.733
K 1. Square on large, flat, limestone ledge between △ 39 S and △ 40 S, 35 feet north of center of Pratt City road at bend on north side of Village Creek Bridge. Large elm southeast 29 feet; △ 40 S northwest 175 feet	533.578
L 1. Square on limestone ledge about 1,500 feet southeast of Thomas Furnaces, 84 feet south of Village Creek, and 317 feet southeast of △ 42 S. Sycamore southeast 150 feet.	529.113
107. Spike, large post oak, 42 feet north of Kansas City R. R., and between △ 43 S and △ 44 S. Large white oak east 30 feet; large sycamore north 20 feet; △ 44 S west 421 feet	529.638
108. Spike, pine, 12 inches, on north side of Kansas City R. R. and 230 feet northwest of Village Creek R. R. Bridge. △ 46 S southeast 210 feet; pine west 18 feet; pine north 20 feet; pine northeast 12 feet	524.163
M 1. Square on limestone rock 4 feet from north bank of Village Creek, 200 feet southeast of △ 49 S. Water oak, 15 inches, north 15 feet; water oak, 18 inches, northeast 24 feet; water oak, 20 inches, northeast 25 feet	509.723
109. Spike, large post oak used as witness for △ 53 S and 23 feet west of station, 400 feet northeasterly from Ensley road. Black oak south 29 feet; large pine east 84 feet.	523.028
Ensley. △ on limestone ledge is also △ Ensley, 25 feet north of Ensley road, near small settlement between McWilliam's spring and Ensley Furnaces. Fence west 25 feet; house southwest 100 feet	522.108

Description of bench marks, topographical survey of proposed Birmingham Canal, 1897—Continued.

Description.	Feet above mean low water at Mobile, Ala
110. Spike, sycamore used as witness to △ 48 S 12 feet north of station. McWilliams Spring Creek east 40 feet; sweet gum west 30 feet	514.408
111. Spike, white oak, 12 inches. △ 55 S northwest 17 feet; white oak north 21 feet; small black oak northwest 29 feet	535.173
112. Spike, water oak, 25 feet south of Warrior road and 500 feet west of Tuscaloosa road at Oakdale Church. △ 59 S north 12 feet	542.128
113. Spike, elm, 15 feet east of center of road running north from Tuscaloosa road. △ 62 S northwest 57 feet; small elm northwest 17 feet; black gum south 15 feet	548.778
114. Spike, water oak, 18 inches, on west side Tuscaloosa road near Burgin plantation and between △ 63 S and △ 64 S. Water oak, 20 inches, north 51 feet; Tuscaloosa road southeast 26 feet	556.938
115. Spike, water oak, 25 inches, south of Dolomite road 70 feet and 500 feet west of Tuscaloosa road. △ 67 S southeast 85 feet; water oak, 20 inches, southwest 21 feet.	533.393
116. Spike, white oak, 20 inches △ 70 S northwest 55 feet; sweet gum south 35 feet	522.418
N 1. Square on limestone ledge 45 feet west of Possum Creek Bridge and 25 feet west of Tuscaloosa road. △ 73 S northwest 350 feet; elm east 53 feet; elm north 18 feet; hickory south 19 feet	508.238
O 1. Square on limestone ledge 30 feet south of center of Tuscaloosa road at crossing of Kansas City R. R., and 23 feet east of Alabama Great Southern R. R. Large hickory south 35 feet; large elm east 75 feet; Possum Creek south 150 feet	498.423
P 1. △ on limestone rock, same as △ 78 S, which is marked with ¼-inch drill hole. Sweet gum northeast 12 feet; white oak south 8 feet	487.623
117. Spike, black oak, about 150 feet south of Possum Creek. △ 82 S southwest 20 feet, small black oak south 24 feet; small mulberry southwest 28 feet	479.648
118. Spike, sycamore, 20 inches, on south bank of Possum Creek and 250 feet north of north end of the Woodward Co. coke ovens. △ 84 S southeast 90 feet; small ash north 11 feet, small ash east 13 feet; small ash southeast 13 feet	471.508
Q 1. Square on limestone rock 44 feet west of Possum Creek and 200 feet east of Alabama Great Southern R. R. △ 86 S northeast 192 feet; small maple northeast 28 feet; pine southwest 16 feet; pine northeast 28 feet; oak east 40 feet	462.993
R 1. Square on hornstone rock 26 feet south of Valley Creek, between Kansas City R. R. bridge and Louisville and Nashville R. R. bridge. South abutment of Louisville and Nashville R. R. bridge west 26 feet; south abutment of Kansas City R. R. trestle east 62 feet; △ 92 S west 150 feet	453.203
S 1. Square on limestone rock, 6 inches north of △ 95 S; south of Valley Creek 127 feet. Small cherry northwest 79 feet; black oak northeast 99 feet	455.453
T 1. Square on limestone ledge 300 feet south of Valley Creek and 130 feet east of Nineteenth street of Bessemer, near bridge. Small pine northwest 17 feet; walnut east 53 feet	453.233
U 1. Square on limestone ledge 45 feet east of Valley Creek and 300 feet north of △ 100 S. Pine southeast 21 feet; pine east 32 feet; pine northeast 38 feet	447.923
V 1. Square on limestone ledge at spring near △ 104 S in old Jonesboro. Large cedar south 19 feet; large cedar west 13 feet; large cedar north 8 feet	440.163
W 1. Square on limestone ledge 6 feet east of Valley Creek. △ 108 S southeast 60 feet; pine southeast 29 feet; oak east 18 feet; oak west 54 feet	434.598
X 1. △ on limestone ledge, same as △ 112 S, and 150 feet southeast of Valley Creek. Black oak east 37 feet; post oak northwest 19 feet; pine west 8 feet	436.793
119. Spike, black oak, 20 inches, midway between △ 116 S and △ 117 S, and 5 feet east of Valley River. White oak south 44 feet; sweet gum east 27 feet; sweet gum north 61 feet	429.058
Y 1. Square on limestone ledge 25 feet south of △ 118 S and west of Valley Creek. Water oak north 13 feet; maple southeast 19 feet	430.283
120. Spike, oak on west side of road at McAdory ford and 24 feet south of Valley River. Black oak west 39 feet; sycamore east 22 feet; △ 121 S west 498 feet	418.008
Z 1. Square on limestone ledge at rock cut, south side of Adger road about one-fourth mile above Jones's mill and 25 feet north of Valley River. △ 126 S north 9 feet; small oak east 12 feet; small oak west 15 feet	420.368
55. Nail, sweet gum, triple trunk, 4 feet. North of Valley River 125 feet and 100 feet east of Jones's mill; 6 feet south of fence along Adger road; 2 red elms west 6 feet; hickory, 14 inches, east 30 feet	414.806
10. Spike, oak, 12 inches, 2 miles east of Adger and 125 feet west of Valley River, at a point 600 feet below Jones's mill. △ 42 N northwest 50 feet	474.798
9. Spike, pine, 8 inches, 2½ miles above iron bridge on Adger road, 300 feet north of field in valley. △ 31 N west 150 feet	413.902
8. Spike, sweet gum, 8 inches, on Adger road 1½ miles above iron bridge and 2,000 feet east of old field in valley. △ 24 N west 200 feet	406.712
7. Spike, post oak, 8 inches, on the Adger road and 100 feet west of small ravine on north bank of Valley River, 1 mile east of water tank on the Birmingham Mineral R. R., △ 13 east 50 feet	399.820
C. Square on coping of east masonry abutment of iron bridge over Valley River on Adger road; 9½ feet north of center of bridge	400.042
11. Spike, elm, 8 inches, about 150 feet west of △ 4 W and 4 feet south of traverse line down Valley River. Near north side of old field, one-half mile below the Adger road.	389.370
12. Spike, hickory, 12 inches, opposite Weaver's mill; 60 feet west of △ 15 W and 20 feet south of traverse line	391.472
13 Spike, white oak, 10 inches, about three-fourths mile below Weaver's mill; 20 feet west of △ 22 W and on traverse line	383.733
14. Spike, oak, 12 inches, on slope of bluff 2,000 feet below mouth of Big Blue Creek; 200 feet east of △ 31 W and 30 feet south of traverse line	403.248
15. Spike, white oak, 18 inches, 50 feet south of △ 40 W	365.503

Description of bench marks, topographical survey of proposed Birmingham Canal, 1897—Continued.

Description.	Feet above mean low water at Mobile, Ala.
16. Spike, cedar, 10 inches, at point of land at large bend in Valley River, about one-half mile east of Dry Jim Parsons's house; 125 feet west of △ 50 W and 3 feet south of traverse line	432.316
17. Spike, pin oak, 18 inches, south of old field 40 feet. About 20 feet south of traverse line and 250 feet west of △ 58 W	355.148
18. Spike, elm, 12 inches, about 100 feet east of field; 500 feet south of ford on Bessemer and Ezra road and 250 feet southwest of Valley River; 260 feet east of △ 64 W and 5 feet north of traverse line	350.290
19. Spike, chestnut, 15 inches, on side of steep hill and 15 feet from Valley River, which makes a long bend at bench mark, changing direction from east to north. 358 feet east of △ 74 W and 4 feet north of traverse line	342.667
20. Spike, oak, 16 inches, opposite cultivated field and 50 feet west of Valley Creek, flowing north. 67 feet west of △ 81 W and 2 feet north of traverse line	349.755
21. Spike, oak, 18 inches, north of Valley River 30 feet, which flows east, and southwest of Lick Creek 1,250 feet. 180 feet west of △ 90 W and 5 feet south of traverse line	346.868
22. Spike, white oak, 10 inches, northwest of ford 250 feet, 10 feet west of road and 60 feet west of Valley River flowing north; 10 feet east of △ 100 W, and 20 feet south of traverse line	350.783
23. Spike, beech, 20 inches, first one east of bend in creek which flows west; 100 feet south of stream at foot of hill; 90 feet west of △ 106 W, and 15 feet south of traverse line	343.910
24. Spike, oak, 18 inches, with vine growing through the trunk. At north end of field in big bend of creek and 50 feet south of stream; 58 feet north of △ 115 W	339.235
25. Spike, white oak, 20 inches, on south bank and 40 feet from Valley River, which flows southwest till 350 feet past bench mark, then changes to southeast. There are wide flats on south side covered with oak woods, the rocky bluffs on north side bordering on stream. 114 feet east of △ 121 W and 8 feet south of traverse line	346.340
D. Square on sandstone bowlder 48 feet east of △ 128 W and 3 feet north of line; about 700 feet south of big ravine and 30 feet east of Valley Creek flowing south. Hill line 90 feet from stream, slopes very steep and covered with oak timber	329.219
E. Square on sandstone ledge, 172 feet west of △ 135 W and on line; 20 feet west of creek, flowing north; 400 feet north of bend and near big ravine; clearing on opposite bank.	329.630
26. Spike, 3-pronged pin oak, 3 inches, 2 prongs broken off 30 feet above ground; 98 feet east △ 144 W and 50 feet west of Valley River and 500 feet southeast of big bend	333.533
27. Spike, white oak, 14 inches, on side of wooded hill 60 feet east of creek flowing south, and 400 feet southwest of Huggins farm and 400 feet west of road; 75 feet east of △ 150 W and 8 feet south of line	336.520
29. Spike, pin oak, 14 inches, on low, sloping ground covered with young pine, about 700 feet north of cotton field; 35 feet east of creek flowing north; 50 feet north of △ 159 W and 20 feet east of line	322.407
30. Spike, red oak, 12 inches, about 40 feet from fence on west side of cornfield; 60 feet east of creek at bend, flow changing from southwest to north, 40 feet ahead of △ 166 W and 50 feet to right of traverse line	320.115
F. Square on coping southwest abutment of iron bridge over Valley River on Tuscaloosa road, 2½ miles east of Ezra	324.242
31. Spike, walnut, 8 inches, in open field one-half mile northeast of iron bridge, 130 feet east of creek; 180 feet ahead of △ 175 W and 8 feet right of line	314.159
32. Spike, pine, 18 inches, in pine flats separating two cultivated fields; 150 feet southwest of stream flowing northwest, and 500 feet beyond bends to the southwest; 125 feet back of △ 182 W and 30 feet left of line	318.873
33. Spike, elm, 12 inches, about 200 feet west of deep ravine and 20 feet south of stream. Steep cliffs approach to within 60 feet of water's edge; above ravine cultivated fields extend to the receding hill lines on both sides; 30 feet ahead of △ 187 W and 2 feet to right of line	307.839
34. Spike, white oak, on south side of wagon road from Rainey's mill to cornfield; on south side of stream and 200 feet east of log dam at Rainey's mill; 150 feet back of △ 195 W and 15 feet left of line	304.349
35. Spike, white oak, 10 inches, about 2,300 feet northeast of first bend below Rainey's mill, 85 feet south of stream, and 100 feet north of fence between open fields and woods, 40 feet southwest of ravine; 200 feet ahead of △ 201 W and 25 feet to right of line	299.903
G. Square on sandstone ledge 25 feet east and 16 feet above bed of stream; east bank very steep. North of bench mark hill line recedes and there is a cotton field along the bank; 8 feet ahead of △ 206 W and 3 feet right of line	295.081
36. Spike, white oak, 30 inches, only tree in field east of deep ravine, dividing fields and woods; 40 feet south of stream, which makes a big bend 500 feet west; 120 feet back of △ 216 W and 20 feet left of line	290.696
37. Spike, hickory, 12 inches, on north bank of rocky ravine, and 40 feet east of stream, which flows east 500 feet above. Steep rock bluffs on east bank, cotton field opposite; 100 feet back of △ 228 W and 25 feet right of traverse line	288.640
38. Spike, mulberry, 10 inches, on edge of hill line and clearing, 280 feet east of stream and northeast of bend; 2,500 feet southwest of point where stream parallels public road; one-half mile southeast of Toadvine; 230 feet east of △ 235 W	290.021
39. Spike, white oak, 14 inches, on south side of public road, one-half mile southeast of Toadvine; 20 feet north of stream and 200 feet west of big bend; 18 feet ahead of △ 239 W	277.574
40. Spike, elm, 12 inches, about 1,800 feet southwest of Toadvine and on east side of wagon road; 900 feet south of Weaver's house and near line fence on west side of road between Weaver's mill and house; 50 feet ahead of azimuth station 4 and 4 feet right of line	330.894

Description of bench marks, topographical survey of proposed Birmingham Canal, 1897—Continued.

Description.	Feet above mean low water at Mobile, Ala.
H. Square on sandstone ledge, about 2,200 feet above Vire's mill; 190 feet east of deep ravine and 50 feet north of stream flowing west; 90 feet back of △ 251 W and on the line	....
41. Spike, white oak, 24 inches, largest oak tree on side of cleared bluff, 1,800 feet northwest of first bend below Vine's mill; 60 feet east of stream and 90 feet northwest of fence running northeast; 80 feet ahead of △ 262 W and 2 feet to right of line	276.001
I. Square on sandstone ledge, 2 feet above surface of ground; 12 feet north of stream and 25 feet south of public road; 100 feet ahead of △ 267 W and 3 feet to right of line	263.764
42. Spike, white oak, 12 inches, about 1,000 feet southwest of two islands in Valley River. On sloping ground covered with good oak timber; 15 feet northeast there are three oak trees in a group, one 30 inches, 50 feet northwest of stream; 140 feet ahead of △ 275 W and 6 feet to right of line	271.978
43. Spike, walnut, 13 inches, on edge of field in bend of stream, midway between two deep ravines 750 feet apart; 50 feet north of stream, which has high bluffs on south side; 40 feet ahead of △ 278 W and 25 feet to left of line	269.258
44. Spike, white oak, 12 inches, about 200 feet below mouth of Mud Creek; 15 feet east of Valley River; 80 feet back of △ 286 W and 2 feet to right of line. A mass of rock 80 feet west projects across the line. White oak, 23 inches, west 20 feet; large double-trunk sycamore, east 50 feet	263.000
J. Square on large sandstone bowlder, 1,400 feet southeast of a rock ford; 195 feet ahead of △ 289 W and 4 feet to right of line. 2 white oaks, 12 inches and 20 inches, northeast 25 feet; 195 feet ahead of △ 289 W and 4 feet to right of line	265.861
45. Spike, water oak, 14 inches, near bend; 50 feet south of stream flowing west, then south. The west bank is lined with steep rock cliffs. The east bank is lined with long, sloping hills. 50 feet back of △ 293 W and 15 feet to left of line	259.179
46. Spike, black gum tree, 13 inches, in woods 600 feet south of shoals in creek. 250 feet ahead of △ 300 W and 3 feet to right of line, and 90 feet west of steam flowing south; about 1,200 feet below it makes a bend of 180° and flows north, passing within 700 feet of bench mark	259.331
47. Spike, hickory, 10 inches, about 1,450 feet south of the Thomas ford, and 66 feet above shoals and 400 feet south of deep ravine; 65 feet west of stream; 66 feet ahead of △ 308 W and 2 feet to right of line. Hickory, 14 inches, south 25 feet	252.083
48. Spike, hickory, 8 inches, within 30 feet of a ravine and small rocky cliff; 1,750 feet north of Roberts Ford; 20 feet west of stream; 30 feet back of △ 315 W and 2 feet to right of line	245.760
K. Square on sandstone bowlder, 12 by 15 feet, within 50 feet of perpendicular cliffs; 15 feet north of stream and 400 feet above deep ravine on south side. North bank, rocky cliffs, and south bank cultivated; 11 feet back of △ 321 W and 4 feet to right of line	236.609
L. Square on projecting sandstone ledge on side of steep hill; 250 feet northwest of island; 30 feet west of diamond shaped sandstone bowlder 10 by 6 by 3 feet thick; 100 feet back of △ 329 W and on line; 80 feet west of stream	264.549
M. △ on slate rock, bottom of stream, second line of rocks below shoals and 23 feet from east bank. Same as △ 336 W, which is center ½-inch drill hole 2 inches deep. Stream flows south, 400 feet below turns and flows northwest	218.196
49. Spike, white oak, 24 inches, south of rock cliffs 150 feet, and 40 feet northwest of rail fence and cotton field; 40 feet northeast of stream; 19 feet back of △ 342 W and 8 feet right of line	232.794
50. Spike, beech, 34 inches, within 200 feet of edge of woods; 30 feet above small ravine and 85 feet above large ravine; 30 feet west of stream flowing west; bend 700 feet below to northwest; 60 feet back of △ 350 W and 2 feet left of line	236.147
N. Square on slate rock, bed of stream, east of ford and 97 feet north of west edge of woods where there is a drop of 10 feet in bank; 15 feet from east bank. Rocks in stream 1 foot above low water; 228 feet southeast of △ 358 W and 15 feet to left of line	212.248
51. Spike, beech, 24 inches, at edge of woods, large field to the west; 50 feet back of ravine and 100 feet west from ridge of high rocky cliffs; 50 feet southeast of bend; above the stream flows east and below north; 7 feet east of △ 365 W	228.067
52. Spike, white oak, 14 inches; 600 feet southeast of shoals and a small island; 200 feet southeast of a ravine and 70 feet southwest of rocky cliffs; 52 feet east of stream; 62 feet ahead of △ 373 W, and 5 feet to right of line. Large white oak north 18 feet	....
O. △ on top of a large urn-shaped mass of sandstone standing in field on side of hill 800 feet east of mouth of Valley River; 100 feet east of stream and 20 feet southwest of first outcrop of rock; 100 feet west of fence on top of hill. Same point as △ 379 W, which has a ½-inch drill hole 6 inches deep	249.490
53. Spike, hackberry, 14 inches; 60 feet from east bank of Warrior River, in bight of big bend midway between Valley River and Heards Shoals; on edge of cotton field, nearly east of road on west bank leading down to the river. Crotched poplar east 50 feet	225.882
P. Square on ledge of rock, first outcrop on east bank of Warrior River at Heards Shoals, 1½ miles below mouth of Valley River; at water's edge and 5 feet east of road at ford; about 500 feet south of old milldam	203.208
Heards Shoals. This bench mark was established by survey of 1895, and its elevation given as	211.350
Top of blazed root of black gum tree; no spike or nail in notch; on west bank of Warrior River and 35 feet north of old mill foundation, and 10 feet from east and west fence; 8 feet from edge of creek	209.756
54. Top of notch on root of poplar, 9 inches; established for current observations; 1,000 feet north of Thomas Ford and 70 feet east of Valley River; on north bank of a ravine and 6 feet south of fence; midway between △ 212 W and △ 213 W and between bench marks 47 and 48; double trunk poplar west 60 feet; double trunk birch northwest 10 feet	249.373

REPORT OF MR. O. W. FERGUSON.

SIR: I have the honor to make the following report on precise level work from Birmingham, Ala., to Meridian, Miss., and from York, Ala., to Demopolis, Ala.

The United States Coast and Geodetic Survey department, in 1885 and 1886, carried geodetic levels from Mobile, Ala., to tide-gauge, at Biloxi, Miss., Appendix No. 9, Report for 1887. From 1884 to 1887 the same department continued these levels to Meridian, heights from geodetic leveling, Appendix No. 10, Report for 1888.

My first orders were to begin at Meridian, but owing to the restriction against travel and shipments, imposed by quarantine, this was changed, and I was ordered to begin at Birmingham.

The fieldwork was done under the direction of Mr. Joseph Ripley, assistant engineer, who at this time was in charge of the survey for the Birmingham and Warrior River Canal.

Reports of the progress of the work were made trimonthly, and a copy of all mailed to Mr. Ripley.

On the 21st of September, 1897, I reported to Mr. Ripley in Birmingham. We at once proceeded to secure proposals for the necessary camp equipment, and borrowed instruments from Maj. J. H. Willard, Corps of Engineers, Vicksburg, Miss. Tents, etc., were purchased in St. Louis, Mo. On September 27 we set up camp at West End, Ala., and continued the preliminary work of completing and fixing up the outfit; selecting places for and setting bench marks; repairing, repainting, and refiguring the precise level rods; adjusting instruments, and taking instrumental values from which tables were constructed for use in carrying along a field computation of results. (Report of Chief of Engineers for 1896, p. 1951.)

On October 2 actual field work was begun. The party consisted of one observer, one recorder, two rodmen, two laborers, and one cook.

ROUTE.

Three permanent bench marks were established in Birmingham. Starting from there, the line of work followed the Alabama Great Southern Railroad track to Meridian, where connection was made with bench mark "C" of the U. S. Coast and Geodetic Survey department. At York, Ala., we established permanent bench mark No. 26 on the above line, and from this the line was run to Demopolis, following the track of the Southern Railway.

No means of transportation were furnished, but authority was granted to employ teamsters with team to move camp whenever necessary. The shortest move made was 5 miles and the longest 11 miles, convenience to work, mail, fuel, and water being the controlling considerations. There were 25 camping places.

INSTRUMENTS.

These were made by A. Kern, of Aarau, Switzerland. For fuller description, see Report of the Chief of Engineers for 1896, page 1950.

Kern level No. 1 with tube No. 8, the first precise level bought for the survey of the Great Lakes, with tripod and level rods Nos. 4 and 12, were furnished.

The "turning points" or "rod supports" were specially designed pins, made of tool steel, borrowed of Maj. Dan C. Kingman, Corps of Engineers, Chattanooga, Tenn. The proper support is of great importance. These are described in Report of the Chief of Engineers for 1896, page 1951.

METHODS OF FIELD WORK.

The methods of field work and field computation of notes were quite similar to those given in report just referred to. All precautions were taken to secure the very best results. In precise level work heretofore, quite frequently errors of one decimeter have been made in reading one of the three wires, and would pass unnoticed by the recorder; in fact, mistakes of one meter have been recorded for each wire. During this season I introduced a variation in the customary mode of reading, which effectually eliminated these errors. Thus in the reading, first wire, 1,571; second wire, 1,685; third wire, 1,801.7, the observer spends far the most labor and thought in estimating the millimeters 1, 5, and 1.7. During part of this study the recorder is waiting. In the former way of reading, when the observer had about decided, he first calls out 71, 85, 01.7, not being fully certain about the 01.7, and being intent upon these millimeters, all again seeming right, he calls quickly, 1,571, 1,685, 1,701.7. He has read the last wire 100 mm. wrongly, and it is not discovered by the recorder.

There is also danger that if, owing to some obstruction, optical illusion, some faint or marred figure, he reads the first wire 571 instead of 1571, he may also read the second 685 and the last one 801.7. Such mistakes have been made, but owing to the duplicate lines they seem to have all been discovered. It is proper to state here that the number of errors found to exist in precise levels after final reduction furnishes the highest testimonial to the system of work. I know of no such error.

My new manner of reading takes no more time, but saves time for the recorder just when he needs it—just when he was greatly crowded under the old way. It secures two looks and two callings-out of the 15, 16, and 18. The first is for the special purpose of finding what their decimeters are. Thus, when the bubble is within four or five divisions of the center position, the eye of the observer being right at the eyepiece, and without stopping or notably interfering with leveling up, he glances through the telescope and calls 15, 16, and 18, the recorder at this stage of the observation having plenty of time. If one wire seems to fall very near to the decimeter graduation, it need not be read, but only those wires of which the observer is certain; and the fact of not reading this wire tends to make the observer and recorder more careful about it when it is finally called out after the millimeters have been read, for, after this first look, the reading is made in the same manner as formerly. This method effectually prevented any error of recording a wire one decimeter out of place.

In field work on precise levels, under Maj. J. H. Willard, Corps of Engineers, the sum of all readings of the three wires was made at the foot of each page, then divided by three and made to check with the sum of mean wires for the same page. Heretofore this had been left until the office reduction. Mr. Ripley introduced this method in this season's work. It is a very valuable check, but requires a recorder rapid in computation to prevent delay.

The elevation of "base of rail" in front of stations and at crossings of other railroads was taken.

Work was carried along from bench mark to bench mark; the average length of these stretches for this season's work was 1,068 meters (3,504 feet). All work was duplicated, the second line being run in the opposite direction from the first line. Computation was then made of the difference of elevations between these bench marks for both lines, and if they agree within

$$\overline{3\text{ mm.}}\sqrt{\text{ }}\text{ twice the distance between the bench marks in kilometers,}$$

the work was passed as good, otherwise two more lines were run between these benches, and so continued until this check was satisfied.

A field tabulation of these results was carried along as the work progressed. It is indispensable as a record to refer to and for comparison with the office reduction.

A plot of discrepancies between the continuous direct and reverse lines was made. It is very valuable as a graphic representation of the errors and of their continuous sum and signs. If there is a *constant* error in the work, though small, it will soon show. This also shows location, direction, and lengths of stretch and the amount that the elevation of any bench varies when determined from these separate lines.

BENCH MARKS.

These were of three kinds—

Permanent, of which there were established	36
Temporary, of which there were established	257
And old, of which there were found	11

Also, the gages below Lock No. 1, Tuscaloosa, and at the Warrior River Bridge were connected with our line.

The line to Meridian was completed on the last day of February, 1898. Orders were then received to move the party to York, Ala., and to run a line thence to Demopolis, Ala. This transfer to York was made on March 1 and camp established.

Field work on the line to Demopolis was begun on the 2d. Three permanent bench marks were established at and near the Tombigbee River. Old bench mark on Demopolis Inn, formerly called the Royal Hotel, was connected with and two new permanent bench marks established in town.

Then we took again observation for the "constants" of the instruments; value of one division of the level tube, wire intervals and amount of inequality of telescope rings. We finished this on the morning of the 29th of March, broke camp, took a list of property, packed, tagged, and delivered it to Webb's warehouse, directed to Capt. T. W. Nicol, assistant engineer, McGrews Shoals, Ala.

All of the party were then discharged except Edgar C. Thompson, recorder, who was retained with myself to make the final reduction of notes. The notes were comprised in 37 books of 60 double pages each.

Each member of the party was faithful and efficient in his work. Edgar C. Thompson deserves special mention for his very accurate and rapid work in recording and computing. Good results in precise levels can not be had without good rodmen. I was fortunate in securing the services of J. F. Ghormley and O D. Sorell for these places. Both were conscientious and careful, and Mr. Ghormley helped the work along materially by his remarkably accurate pacing.

OFFICE REDUCTION.

The books were indexed and all observations for instrumental values checked and recomputed. The necessary tables were then made out—enumerated in Report of the Chief of Engineers, 1896, page 1955. Upon the twelve sheets of computation paper (A to L) accompanying this report are given these computations and tables.

STANDARD LENGTH OF ONE METER ON RODS USED.

No recent comparisons of rods 4 or 12 have been made, but Assistant Engineer T. C. Thomas, in the office of Maj. J. H. Willard, writes that Lake Survey rod 4 was compared with rod 2 at Delta, La., on February 16, 1889, and the value of 1 meter on former calculated, using the value of 1 meter on rod 2, published in Report of Mississippi River Commission for 1881, page 51. This gave for 1 meter on rod 4, 0.999928 m. Again, on September 21, 1892, Red River precise level rod 3 was compared with Lake Survey rod 4, and in 1894 rod 3 was standardized by the Coast Survey department at Washington, D. C. The standard value thus found for rod 3 verified its value as derived from rod 4. Therefore we take 1 meter on rod 4, 0.999928 m., and 1 meter on rod 12, Report of Chief of Engineers for 1884, page 2464, 0.999973 m. Since both rods were equally used in the work we take the mean of their values to be the standard length of meter used, 0.9999505 m. Therefore the preliminary elevations above and below any bench mark in the system are numerically too much above and below this point by 0.0495 mm. for every meter that they are above or below. To apply this "rod correction," we start at P.B.M. 3 on the custom-house building, Birmingham, Ala., with elevation of 164.71549 m., equal 540.410 feet, referred to preliminary datum for canal survey.

Value of instrumental factors used in office reduction, Kern level No. 1, tube No. 8.

	October 1 to 18, inclusive.	October 19 to November 30, inclusive.	December 1 to 29, inclusive.	December 30 to January 31, inclusive.	February 1 to March 29, inclusive.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
N in seconds	3.278	3.278	3.278	4.046	4.046
S in meters	62.927	62.927	62.927	50.981	50.981
Cor. for P. per m. in mm	— 0.013	— 0.013	— 0.000	0.0000	+ 0.011
Interval for 1 m. in mm	4.017	3.6103	3.6103	3.6103	3.6103
A of rods 4 and 12	—52.7 mm.	—52.7	—52.7	—52.7	—52.7
Standard length of 1 m. of rods 4 and 12	0.9909505	0.9999505	0.9999505	0.9999505	0.9999505

N equals the number of seconds in one division of tube.

S equals the distance at which the movement of bubble over any number of divisions of tube corresponds to a movement of the wire over the same number of millimeters on rod.

P equals correction in millimeters per meter, due to the inequality of telescope rings.

A is the quantity that must be applied to any usual reading to give the distance from the point that the rod rests upon up to the point of intercept.

All observations and quantities derived therefrom, and summations in the 37 field books, were checked and marked in red. Then a new draft of the difference of elevation, from point to point, was made upon 88 sheets of computation paper accompanying this report. From these a new tabulation of results for all points was then made. It is comprised upon 32 sheets of tabulation paper presented herewith, including a list of elevations of base of rail at 48 different places, useful for State, county, geological, and topographical surveys.

The field reduction proved to be remarkably free from errors; only one error was found as large as 1 mm., and only fourteen as large as 0.4 mm., and many smaller. But in no place was the elevation changed more than 3 mm. No error in sign, affecting elevations, was made, but there were two errors made in sign of residuals.

In the "summation of residuals," the direct and reverse lines are considered as independent and continuous, and the quantities give the amount that these lines are respectively above or below the mean line. At Cuba, Ala., this quantity reached its maximum, ± 12.15 mm., which signifies that the elevation carried by the direct line from the initial point is 24.3 mm., below the elevation carried by the reverse line from the initial point, 133.5 miles distant. This discrepancy shows heaving of rod supports. In the latter part of this distance, particularly near Epes, Ala., the ground is of clay and some gravel, dry and tough, and would heave back a small amount after the pin was driven and carry the pin up with it. On the line, York to Demopolis, 28.7 miles, this divergence amounted to ± 3.72 mm.

Table showing the amount of line completed and number of times that it was run.

Line.	Meters.	Miles.	$\frac{1}{1000}$ of the whole.	Single line run.
				Meters.
Total completed	306,889	190.732	....	....
Amount run twice	299,071	185.873	974.524	598,142
Amount run 3 times	635	.395	2.070	1,905
Amount run 4 times	7,183	4.464	23.406	28,732

Total length of single line run....meters.. 628,779
Total length of single line run....miles.. 390.787

Only 2.55 per cent of the work did not check within the prescribed limit, 3 mm $\sqrt{2\ K}$, without rerunning.

Main line completed, 295.019 k., equals 183.355 miles.

Side line completed, 11.870 k., equals 7.377 miles.

RATE OF PROGRESS.

From the time that field work began (October 2, 1897) to breaking up of party (March 29, 1898), both inclusive, there were 179 days, less 26 Sundays—153 week days.

Average progress per day, 1.25 miles, including holidays and time in which no work was done on account of bad weather or moving camp. Usually work was carried on while camp was being moved. Average length of single line run for the one hundred and fifty-three days, 4,110 meters, 2.55 miles.

DEGREE OF PRECISION OBTAINED.

For the 154 miles, from Birmingham to Meridian, the probable error of final result is R., 8.72 mm. Number of kilometers in this line, 248.846, and the probable error per kilometer—

$$x = \frac{8.72}{\sqrt{248.846}} = \pm 0.55 \text{ mm.}$$

$$x \text{ for the first 50 k.} = \pm 0.49 \text{ mm.}$$
$$x \text{ for the second 50 k.} = \pm 0.59 \text{ mm.}$$
$$x \text{ for the third 50 k.} = \pm 0.51 \text{ mm.}$$
$$x \text{ for the fourth 50 k.} = \pm 0.56 \text{ mm.}$$
$$x \text{ for the last 48.8 k.} = \pm 0.59 \text{ mm.}$$

On the line York to Demopolis—

$$x \text{ for the 46.173 k.} = \pm 0.48 \text{ mm.}$$

All showing a pretty uniform quality of work.

This quantity x, for the Mississippi River work, "St. Paul to Savannah," equals ± 0.625 mm. For the Missouri River line "St. Joseph to the mouth," $x = \pm 0.58$. For the Tennessee River line, Corinth, Miss., to Decatur, Ala., $x = \pm 0.62$.

I have unbounded confidence in the results of this season's work, and believe that it is, excepting the line for the Chicago Drainage Canal where the limit was 3 mm. $\sqrt{k}$., a little the best line on record.

PLANE OF REFERENCE.

Upon starting the line at Birmingham, the elevation of my permanent bench mark, No. 3, on the custom-house, was taken or given by Mr. C. E. Thompson, leveler, from Mr. Joseph Ripley, on survey for Birmingham-Warrior River Canal, 540.410 feet. This was used in the field and for the preliminary office reduction. I find United States Coast and Geodetic Survey bench mark "C," meridian, to be 89.15474 m.

The elevation of this bench mark "C" above the United States Coast Survey, "average Gulf level at Biloxi, Miss.," Appendix No. 10, Report for 1888, page 417, 104.8894 m.

United States Coast and Geodetic Survey bench mark "A" on the customhouse, Mobile, Ala., Appendix No. 9, Report for 1887, page [illegible]; also Appendix No. 10, Report for 1888, page 411, above the same "average Gulf level at Biloxi, Miss.," 3.7251 m.

From your letter of February 28, 1889, I learn that this bench mark "A" is 13.51 feet above mean low water at Mobile, Ala., which is the plane that it is desired to refer all of our bench marks to.

13.51 feet equals 4.11781 m.; therefore mean low water at Mobile is 0.39271 m. below the United States Coast Survey "average Gulf level at Biloxi."

	Meters.
Adding this quantity, then, to the elevation of "C" or	104.8894
Elevation of "C" above mean low water, Mobile	105.28211
Preliminary elevation	89.15474
Therefore constant to be added to preliminary elevation	16.12737

The preliminary elevation plus this quantity and rod correction given give the final elevation, in ink, on the tabulation sheets.

	Meters.
The preliminary elevation of permanent bench mark No. 26, from which we start the line York to Demopolis, Ala	31.73512
Constant	16.12737
Rod correction	+.00658
Elevation above mean low water, Mobile	47.86907

The accompanying list of 256 bench marks, described on 44 sheets of computation paper, give all permanent bench marks, all old bench marks, and all gauges; also all of the temporary bench marks that will be good for a number of years. Some of them will last for many years.

During this season's work there were 625 lines run from one bench mark to another. Of these, 7 pairs (14 runs) were rerun because the first pair of lines did not check sufficiently close. Of these 14 lines 2 were rejected, for, judging from the usual check, their variation from the means of other lines between the same points were so great that it seemed proper to attribute them to some accident. The first rejected was the first "direct" line between temporary bench marks 191 and 192; distance, 1,210 meters; divergence from the mean of the other 3 lines, 8.4 mm. The second line rejected was the first "reverse" between temporary bench marks 25 and 26; distance, 1,490 meters; divergence from the mean of the other 3 lines, 6.13 mm. Thus there were but 2 lines out of the 625 that showed errors which could be considered large, and they were but 0.028 and 0.20 foot, respectively.

This gives a measure of the reliability and precision of the results.

It is a most excellent, straightforward, and practical system of precise work; it is unencumbered with any side measures or corrections. The errors that generally vitiate levels are eliminated in the observations; the results are taken from the readings direct. The work moves right along, speedily; there is need for but very little signaling, and there is no confusion. The observer makes the complete observation; the recorder stands near by and writes down the numbers called off, and without the use of any chain, measuring stick, or loss of a minute, he keeps the sum of the foresights running along within a meter or two of the same amount as the backsights, and closes the stretch with excess usually amounting to less than a meter. With care in the field reduction, results are quite certain. The corrections due to change of value in instrumental factors, change in the excess of sights, and perhaps some errors in applying these little corrections aggregate but a small amount, and so do not affect the elevations very much, but complete work requires that these be attended to.

The chief value of the office reduction is to verify the results found in the field reduction by an independent count, from point to point, in regard to both sign and amount, and thus locate the cause of any variation and secure the right result. The field reduction then serves also as something to rest the independent chain of results of the office reduction upon, for comparison. The final results are then brought up to about the same grade that the instruments and observations hold.

Respectfully submitted.

O. W. FERGUSON

Maj. WILLIAM T. ROSSELL,
Corps of Engineers, U. S. A.

DESCRIPTION AND ELEVATION OF PRECISE LEVEL BENCH MARKS FROM BIRMINGHAM, ALABAMA, TO MERIDIAN, MISSISSIPPI, AND FROM YORK, ALABAMA, TO DEMOPOLIS, ALABAMA.

All elevations are given in both meters and feet, and refer to mean low water at Mobile, Ala., which is 1.256 feet below "average tide level" of the Gulf of Mexico, as determined by the United States Coast and Geodetic Survey Department. The value of one meter used is 3.2808693 feet.

These benches are numbered consecutively from Birmingham to Meridian, and anew from York to Demopolis.

A P. B. M. is a bench mark set to be practically permanent; it consists of a piece of copper rod three-eighths inch in diameter and 3 inches long, upset at the inner end and leaded either horizontally or vertically, and is always marked, when possible, $\overset{\text{U S}}{\underset{\text{P B M}}{\odot}}$ by letters 1¼ inches high, about one-fourth inch heavy, and three-sixteenths of an inch deep, cut in the stone. When set horizontally, the outer end of the bolt stands about one-fourth of an inch back of the face of the stone and the indentation of a "center punch" is made in the center of this end, the center of which is the point of reference. When set vertically, the top of the copper bolt, which is the point of reference, projects above the surface of the stone about 0.003 of a foot.

A T. B. M. is a bench mark, reliable and firm for the time being, but usually of less permanency than a P. B. M. They are spikes driven in the base of trees, stumps, or timber work or the highest point inside of square cut on rock. When on trees, a shoulder is cut on a root or on the base of the tree, then the spike is driven into this clear to the head, the top of the spike being the point of reference; the tree is usually then blazed directly over the spike. When on rock, a square is cut about 1¼ inches on a side and about three eighths inch deep; it is then rounded up toward the center, which, when possible, is so selected that it is a little higher than the average surface of the stone. When a spike is used, the bench is provided with a washer about seven-eighths inch in diameter with center hole of one-fourth inch. The spike is driven down firmly upon this washer. From T. B. M. 112, inclusive, 1¾ miles above Akron, these washers bear the numbers of the T. B. M., stamped on the rim by a set of dies. These improvements with reference to the washers were ordered by Mr. Joseph Ripley.

Description and elevation of precise level bench marks between Birmingham and Meridian.

Number.	Description.	Elevation.	
		Meters.	Feet.
P. B. M. 1	Is in Birmingham, Ala., in the southeast corner of west wing of court-house, 10 inches from east corner, second course above base stone, being center of "center punch" mark in copper bolt leaded horizontally	186.4611	611.754
T. B. M. 1	Is in Birmingham, Ala., at the Third avenue entrance to court-house, west side on base stone of fence behind stone post, being highest point in square	185.2240	607.696
Birmingham. P. B. M. 2	Is in Birmingham, Ala., on the northeast corner of First avenue and Nineteenth street, about 72 feet north of First avenue, on base stone under sixth pillar of L. Sak's store, on south end of stone, being top of copper bolt leaded vertically	181.9438	596.934
P. B. M. 3	Is in Birmingham, Ala., in north side of west entrance to custom-house, on third step from top, between pillar of arch and pilaster, being top of copper bolt leaded vertically	180.8429	593.322
T. B. M. 2	Is in Birmingham, Ala., on north side of the "dummy" car track, about 3,600 feet below the post-office or custom-house on Eleventh street in front of store, 10 feet west from end of curbing at waterway, being square cut on curbing	176.5466	579.226
Elyton. T. B. M. 3	Is in Elyton, 325 feet east of section-house 160, on stone culvert on the northeast corner, 18 inches from edge of timber, being highest point in square	174.4792	572.443
T. B. M. 4	Is three-fourths of a mile above West End, Ala., midway between milepost "145 C" and road crossing, in low ground in south field, 60 feet from center of track, in base of an elm tree 18 inches in diameter, being top of spike	172.4158	565.674
West End. T. B. M. 5	Is at West End, Ala., 240 feet south of the mail stand crane and 140 feet west of the Alabama Great Southern track, in base of an oak tree 16 inches in diameter, being top of spike	173.6094	569.590
T. B. M. 6	Is 1 mile below West End, Ala., and 500 feet below whistle post in east line of right of way Alabama Great Southern R. R., on Spanish oak, being top of spike	171.2010	561.688

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
West End.*			
T. B. M. 7	Is 1¼ miles west of West End, Ala., on line of the Alabama Great Southern, 328 feet east of road crossing, in center of south end of the southeast abutment of top stone, being highest point in square	166.4254	546.020
T. B. M. 4	Is on line of the Alabama Great Southern, 1¼ miles above Powderly, 470 feet below center of road crossing, 29 feet south of center of track, in very large bowlder forming the north bank of ditch, being top of copper bolt leaded vertically	160.7759	527.485
T. B. M. 8	Is at Powderly, 100 feet below crossing of Alabama Great Southern and dummy line, 50 feet south from center of track on upper part of large ridge of rock, being highest point in square	157.6940	517.373
T. B. M. 9	Is 66 feet below milepost 146 from Meridian, and 13 feet north of center of track, being highest point in square cut on bowlder	160.2729	525.834
T. B. M. 10	Is 1¼ miles east of Hillman Station, 100 feet below bridge 84, and 26 feet north of track, on stone ledge, being highest point in square	159.4822	523.076
T. B. M. 11	Is 250 feet above Hillman switch at the north side of bridge No. 85, on very large rock in bed of Downeys Creek, being highest point in square cut on rock	156.6488	513.944
Hillman.			
Wheeling.			
T. B. M. 13	Is about halfway between mail crane at Turpin post-office and crossing of road to mines; on northeast abutment of viaduct on second step from top and 5 inches from first step, being highest point in square	158.2969	519.352
T. B. M. 14	Is in Bessemer, Ala., 1,300 feet east of brickyard and 39 feet north from center of track, in front of and 14 feet from 12-inch sweet gum tree, on center of rock in place dipping north, being highest point in square	159.4856	523.087
T. B. M. 15	Is in Bessemer, Ala., 300 feet above the crossing of the Alabama Great Southern and Louisville and Nashville tracks, on southeast corner of stone culvert, being highest point in square	157.4691	516.635
T. B. M. 16 Bessemer.	Is in Bessemer, 164 feet south of Nineteenth street and 45 feet west of that portion of the dummy track lying parallel to the Alabama Great Southern track, being spike in root of cedar tree 1 foot in diameter	158.3864	519.645
P. B. M. 5	Is in Bessemer on the southeast corner of Nineteenth street and Fourth avenue at the main (corner) entrance of brick building with stone trimmings, occupied by the Bessemer Loan and Improvement Company, in east end of top stone, being top of copper bolt leaded vertically	156.8256	514.524
T. B. M. 17	Is one-half mile south of Bessemer depot, 328 feet south of road crossing, and 75 feet east of center of track on the large elm tree, being top of spike driven in root	153.0398	502.104
T. B. M. 18 Jonesboro.	Is in Jonesboro at the north side of the track in base stone of the southeast corner of water tank, being highest point in square	155.8200	509.585
T. B. M. 20	Is 980 feet north of Mobile Junction, and 185 feet south of last cabin on the east side of track, and 54 feet from center on a large post oak, being spike in root	152.5850	500.611
Mobile Junction.			
T. B. M. 21	Is 1 mile below Mobile Junction, 135 feet south of small trestle, and 40 feet from center of track, on a large water oak, being spike in root	155.8820	511.428
T. B. M. 22	Is 328 feet north of milepost 136 from Meridian, and 54 feet east of center of track on red-oak tree (blazed) at edge of woods, being spike in root	155.7947	511.142
McCalla.			
T. B. M. 23	Is at McCalla, 470 feet south of road crossing, and 54 feet west of center of track on water-oak tree, 1 foot in diameter, being spike in root	149.4628	490.368
T. B. M. 24	Is three-fourths of a mile below McCalla, about 1,700 feet below bridge No. 87, on southeast corner stone of open culvert, being highest point in square	150.9211	495.153
T. B. M. 25	Is about 1¼ miles below McCalla and 1,550 feet below milepost 133 M, on west side of track, opposite large pine, on base of water-oak tree 14 inches in diameter, being top of spike	159.3358	522.760
T. B. M. 26	Is about 1¼ miles above Baylor and 1,080 feet above milepost 132 M, on east side of track at edge of woods, on base of a red-oak tree, being spike in root	162.6873	533.756

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
McCalla.			
T. B. M. 27	Is one-fourth mile above Baylor and 490 feet north of milepost 131 from Meridian, on the northwest corner of culvert, on third step from bottom, being highest point in square cut on stone	152.3609	499.87
Baylor.			
T. B. M. 28	Is one-fourth mile below Baylor and 195 feet north of cattle gap, 30 feet east from center of track, on base of red-oak tree, being top of spike	150.6970	494.41
P. B. M. 6	Is at Kimbrell, 57 feet west from center of track, at a point 550 feet above the upper fence at crossing, on a very large ridge of limestone rock, 50 feet above pyramidal point at lower end of rock and 8½ feet from cedar tree 4 inches in diameter, being top of copper bolt leaded vertically	150.0959	492.44
Kimbrell.			
T. B. M. 29	Is three-fourths mile below Kimbrell, 460 feet south of milepost 129 from Meridian, 72 feet east of center of track at edge of pine grove, in base of pine tree 18 inches in diameter, being top of spike	150.2675	493.00
T. B. M. 30	Is at Tannehill, at north side of road, near road crossing, 98 feet west of center of track, on large cedar tree, being top of spike in base	144.1008	472.77
Tannehill.			
T. B. M. 31	Is opposite the frog at lower end of Tannehill siding, 54 feet west from center of track, in base of a large pine tree, being top of spike	147.4941	483.90
T. B. M. 32	Is about 1¼ miles south of Tannehill and one-half mile above Standiford, 656 feet south of milepost 127 from Meridian, at southeast corner of bridge No. 94, being highest point in square cut in stone	147.7704	484.81
Standiford.			
T. B. M. 33	Is about one-fifth mile below Standiford, on first rise of ground in fill, 75 feet west of center of track, in base of pine tree, being top of spike	153.1677	502.52
T. B. M. 34	Is 1 mile above Green Pond and three-fourths of a mile below bridge No. 95, 390 feet above cattle gap, 40 feet east of center of track, on base of pine tree about 14 inches in diameter, being top of spike	162.4117	532.85
T. B. M. 35	Is about 1,900 feet above Green Pond, 175 feet south of milepost 125 from Meridian, on high ground at deep cut, 40 feet west of center of track, in base of a post-oak tree 3 feet in diameter, top broken out, being top of spike	173.3301	568.67
Green Pond.			
T. B. M. 36	Is 720 feet below the mail crane at Green Pond, 45 feet east of center of track, in base of hickory tree 8 inches in diameter, being top of spike	170.9645	560.91
T. B. M. 37	Is three-fourths mile north of Woodstock, at the north end of large fill, 50 feet east of center of track, on base of a pine tree 2 feet in diameter, being top of spike	159.4349	523.08
Woodstock.			
T. B. M. 38	Is in Woodstock, at road crossing, on south side of street and 20 feet west from center of track, on the very large water-oak tree, being top of spike in base	152.1154	499.07
T. B. M. 39	Is three-fourths of a mile below Woodstock and 334 feet south of milepost 122 from Meridian, on southwest corner of culvert, 2 feet from end of stone, being highest point in square.	151.9389	498.48
T. B. M. 40	Is 1¼ miles below Woodstock, 262 feet below cattle gap, 45 feet south from center of track, on base of a large red-oak tree, being top of spike	154.0498	505.41
Bibbville.			
T. B. M. 41	Is at Bibbville, in the southeast extremity of town, in front of cabin, at end of cut, 125 feet east of track near pond, in base of triple catalpa tree, being top of spike	162.7973	534.11
T. B. M. 42	Is about three-fourths of a mile below Bibbville, on south side of track, opposite milepost 120 from Meridian, being highest point in square cut in stone	151.4856	497.00
T. B. M. 43	Is 1½ miles below Bibbville, 1,930 feet below bridge No. 98, behind tool house No. 192, and in front of section house, on large lone-pine tree, being top of spike in base	144.5188	474.14
T. B. M. 44	Is 1½ miles above Vance, 720 feet south of bridge No. 99, 45 feet south of center of track, on the large red-oak tree, being top of spike in base	140.9210	462.34
T. B. M. 45	Is three-fourths mile above Vance and 100 feet above milepost 118 from Meridian, at border of field 55 feet north from center of track, on red-oak tree, being top of spike in base	151.5904	497.34
P. B. M. 7	Is about one-half mile above Vance, 1,312 feet south of milepost 118 from Meridian, 328 feet south of old gin house, on north end of culvert marked 1888, upper side, on first step below coping, being top of copper bolt leaded vertically	147.9562	485.42

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
Vance. T. B. M. 46	Is 900 feet below the depot at Vance and 50 feet north from center of track on lone post oak tree, being spike in base	155.9516	511.657
T. B. M. 47	Is three-fourths mile below Vance, about 2,950 feet below milepost 117 from Meridian, on northwest corner of small culvert, on second step from top, being highest point in square	144.2375	473.224
T. B. M. 48	Is 1¼ miles below Vance and 50 feet below milepost 116 from Meridian, 48 feet east of track, on base of red-oak tree, being top of spike	142.1554	466.398
T. B. M. 49	Is 1½ miles above Dudley, 575 feet south of milepost 115 from Meridian, 60 feet east from center of track on base of pine tree, being top of spike	130.2224	427.243
Dudley. T. B. M. 51	Is 196 feet below Dudley Station and 50 feet north from center of track, on pine tree, being top of spike in base	124.0969	407.146
T. B. M. 53	Is 820 feet above the crossing at Clements, and 70 feet north from center of track, in base of red-oak tree, about 6 inches in diameter, being top of spike	138.7301	455.155
Clements. T. B. M. 54	Is one-half mile below Clements, 1,970 feet above milepost 111 from Meridian, and 1,050 feet south of south end of switch at coal mine, 50 feet east from center of track, on post-oak tree, being top of spike in base	129.5939	425.180
T. B. M. 55	Is about one-third mile above Coaling, and 250 feet above mile post 111 from Meridian on pine tree, about 10 inches in diameter at west end of cut, 60 feet north from center of track, being spike in base	121.7663	399.499
Coaling. T. B. M. 56	Is in Lower Coaling, 310 feet below lower end of switch west of Coaling, at side of wagon road, 66 feet south from center of track, on base of lone post-oak tree, 3 feet in diameter, being top of spike in base	118.5680	389.006
P. B. M. 8	Is about 795 feet below Coaling Station, on south end of culvert, under the Alabama Great Southern track, on west side, third step from top, on corner of stone 11 inches north of south end and 11 inches from east face, being top of copper bolt leaded vertically	113.6826	372.978
T. B. M. 57	Is three-fourths mile below Coaling, 425 feet below milepost 110 from Meridian, 70 feet north of center of track, on base of Spanish-oak tree (blazed), being top of spike	126.1145	413.765
T. B. M. 58	Is 160 feet above crossing at Fleming, 90 feet south of center of track, on base of red-oak tree, 20 inches in diameter, being top of spike in base	121.2171	397.697
Fleming. T. B. M. 59	Is three-fourths mile below Fleming, and 1,535 feet above water tank, 63 feet north from center of track, on red-oak tree, being spike in base	107.3021	352.044
Johnson. T. B. M. 60	Is 50 feet above the lower end of rock cut below Johnson, on shelf of rock, on south side of track, and of same elevation as top of rail, 20 feet below old fence on opposite side of track; an arrow is cut below, pointing up to the bench, being highest point in square	99.4169	326.174
T. B. M. 61	Is about one-half mile above Olmstead, 1,195 feet below milepost 107 M, at lower end of long fill, 45 feet north from center of track, on base of pine "blazed," being top of spike	94.3452	309.534
Olmstead. T. B. M. 62	Is at Olmstead, at east side of wagon road, near crossing just below Olmstead, 40 feet north from center of track, on base of large post-oak tree, being top of spike	85.0026	278.882
T. B. M. 63	Is three-quarters mile below Olmstead, at the west end of upper solid rock cut on north side, being highest point in square.	91.2438	299.359
T. B. M. 64	Is about 1½ miles above Cottondale, 360 meters below milepost 105 from Meridian, 60 feet from center of track, on base of pine tree, being top of spike	91.7930	301.161
T. B. M. 65	Is one-half mile above Cottondale, 1,690 feet below tool house No. 205, 45 feet north of center of track, on base of pine tree, being top of spike	84.9896	278.840
P. B. M. 9	Is 1,640 feet above Cottondale Station, on north end of large stone culvert, on west end of coping stone, 2 feet east of the west edge and 6 inches from north face, being top of copper bolt leaded vertically	75.2429	246.862
Cottondale. T. B. M. 67	Is 3,370 feet below Cottondale and 90 feet below corner of fence, 50 feet west from center of track, on base of pine tree, being top of spike	93.7866	307.701

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
Cottondale.			
T. B. M. 68	Is about 1¼ miles below Cottondale, 305 feet below milepost 103 from Meridian, at upper end of cut, on base of large Spanish oak tree with broken top, 50 feet south from center of track, being top of spike	99.1057	325.153
T. B. M. 69	Is 2 miles below Cottondale, 740 feet below milepost 102 from Meridian, on the west side of track and southwest corner of small stone culvert, being the highest point in square cut in stone	107.1321	351.486
T. B. M. 70	Is 2⅝ miles below Cottondale, 1,280 feet above milepost 101 from Meridian, on the northwest corner of small open culvert, being highest point in square	110.5823	362.806
T. B. M. 72	Is 164 feet below milepost 100 from Meridian, at point of curve and side of track, on top of iron tangent post, being highest part of post	92.8293	304.561
T. B. M. 73	Is one-half mile below milepost 100 from Meridian, 57 feet east of center of track, on large yellow-pine tree, being top of spike in base	85.7392	281.299
T. B. M. 75	Is 1⅝ miles above Tuscaloosa depot and one-fourth mile above milepost 98 from Meridian, on south end of large stone culvert, on east end of coping stone, being highest point in square	65.6563	215.409
T. B. M. 76	Is about 1 mile above Tuscaloosa, 2,850 feet below milepost 98 from Meridian, 50 feet north of center of track, on base of large pine tree, being top of spike	65.3377	214.365
T. B. M. 77	Is one-third mile above Tuscaloosa, 555 feet below tool house No. 209, 40 feet north from center of track, on base of pine tree about 7 inches in diameter, being top of spike	60.2475	197.664
Old B. M. 1	Is at Tuscaloosa depot, 200 feet south of Alabama Great Southern depot, on base of gum tree, being top of new spike, with washer, of same elevation as old nail, the latter being loose	55.3591	181.626
T. B. M. 85	Is in Tuscaloosa, on east side of dummy-line track, 1,700 feet above Alabama Great Southern depot, in front of the Kennedy House, on large water oak tree, being top of spike in base	66.8576	219.351
T. B. M. 86	Is in Tuscaloosa, at the corner of Washington and West Pike streets, on base of very large live-oak tree in the middle of West Pike street, being top of spike	67.5555	221.641
P. B. M. 11	Is in Tuscaloosa, on the southwest corner of Market and Cotton streets, on the city hall, on stone base under window sill, 19.7 feet south of the main entrance, being top of copper bolt leaded vertically	68.2945	224.065
Tuscaloosa.			
T. B. M. 87	Is in Tuscaloosa, in the northeast quarter of town, in front of Mrs. Thomas's residence, on north side of road, at a point where it begins to descend the bluff leading to Lock No. 1, on very large live oak, being top of spike	69.8735	229.246
Old B. M. 3	Is at Lock No. 1, on the land corner stone nearest head of steps leading down to lock walls, on the surface at southeast quarter of cross. (Old elevation 148.60)	45.1444	148.113
P. B. M. 12	Is in Tuscaloosa, at Lock No. 1, Warrior River Canal, on south wall of lock, east end, 9 inches from edge of wall just above recess for gate, being top of copper bolt leaded vertically	34.7016	113.851
Lock No. 1.			
Old B. M. 4	Is at Lock No. 1, on face angle of coping at the southeast quoin of Lock 1, being small circle cut inside of square. (Old elevation 114.30)	34.6954	113.831
Old B. M. 5	Is on south pier of Tuscaloosa County Bridge, on projection of foundation course, being top of iron bolt leaded vertically. (Old elevation 93.82)	28.4659	93.393
2-foot mark of gauge.	This is an inclined gauge set with the slope of the bank about 980 feet below the south pier of the new Mobile and Ohio Bridge	27.0942	88.893
Old B. M. 6	Is on side of bank 10 feet west of gauge, on base of a 10-inch willow, being top of nail	29.6840	97.369
P. B. M. 13	Is about 980 feet below pier of the new Mobile and Ohio Bridge at the west side of the inclined gauge, under the forty-third foot mark, on stone monument set in ground, being top of copper bolt leaded vertically	38.9975	127.946
P. B. M. 10	Is in Tuscaloosa, 1,145 meters below the Alabama Great Southern depot, on north end of stone culvert, on second step below coping, 6 inches from first step, and 8 inches from face of second step, being top of copper bolt leaded vertically	51.2683	168.205
T. B. M. 78	Is five-eighths mile below depot at Tuscaloosa, 460 feet below milepost 96 from Meridian, on east end of brick culvert, being highest point in square cut on brick	52.1200	170.999
T. B. M. 80	Is 2½ miles below Tuscaloosa, 740 feet below road crossing, and 295 feet above milepost 94 from Meridian, on west end of stone culvert and south end of coping, being highest point in square	42.4225	139.183

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
Lock No. 1.			
T. B. M. 83	Is $4\frac{3}{10}$ miles below Tuscaloosa, and 2.653 meters below bridge 121½, 50 feet north from track on base of large beech tree at edge of woods, being top of spike	40.0626	131.440
T. B. M. 84	Is three-fourths mile above Englewood, 246 feet below bridge 123, 50 feet east of track at edge of woods on pine tree, being top of spike	39.0707	128.186
Englewood.			
T. B. M. 88	Is at Englewood, 180 feet above lower end of switch on cement top of east end of iron culvert pipe, being highest point in square	42.6132	139.809
T. B. M. 90	Is at Maxwell, 50 feet below warehouse and 70 feet west from center of track on large sweet gum tree 2½ feet in diameter, in most prominent root, being top of washer, the spike having been driven so hard by unknown party that the washer stands above head of spike	45.9261	150.678
Maxwell.			
T. B. M. 91	Is at Phifer, at the north side of store near rear corner, 40 feet east from center of track on base of large red oak tree, being top of spike	53.5948	175.838
Phifer.			
T. B. M. 92	Is 1¼ miles above Hull, 650 feet below milepost 88 from Meridian at lower end of short cut, 50 feet north from center of track in base of large red oak tree, being top of spike	44.4820	145.940
T. B. M. 94	Is in Hull, 100 feet south of station on west end of culvert, on top of first brick north of center joint over iron pipe, being highest point in square	39.5891	129.887
Hull.			
P. B. M. 14	Is in Hull, Ala., 63 feet above the north end of station and 10 feet east of center of track, on brick culvert, 1 foot from north face and 6 inches from end, being top of copper bolt leaded vertically	39.8618	130.781
T. B. M. 95	Is 3,100 feet below Hull, Ala., and 1,120 feet below milepost 86 from Meridian, 50 feet east from center of track, on large root of pine tree, 15 inches from base, being top of spike	37.4749	122.950
T. B. M. 96	Is 1½ miles below Hull, Ala., at Big Sandy Creek, on the southeast corner of chord of bridge, being top of spike in center of square cut in timber	40.0119	131.274
Big Sandy Creek.			
T. B. M. 98	Is about 3 miles below Hull, Ala., 750 feet below cattle gap, and 92 feet below brick culvert, on third pile from south end of last row of retaining piling, being top of spike with washer	49.2864	161.702
T. B. M. 100	Is in Moundville, Ala., 164 feet below depot, on foundation stone of water tank, on the northwest corner of the west one of the two north pillars, being highest point of square cut on stone	50.3163	165.081
Old B. M. 9	Is 300 feet west of depot, on south side of road directly opposite Mr. Prince's gin mill, on root of large wild cherry tree, being top of spike with washer, driven very approximately to the same elevation as old bench mark. The old nail had rotted out. (Old elevation, 164.43)	49.9242	163.795
Moundville.			
P. B. M. 15	Is in Moundville, about 170 feet south of depot, in foundation stone of water tank, in the northwest corner of the southwest pedestal of center quadrilateral, being top of copper bolt leaded vertically	50.3273	165.117
T. B. M. 102	Is about 1½ miles below Moundville, 200 feet above the lower end of long tangent, at first telegraph pole below small crossing, on stump of old cedar telegraph pole, being top of spike	46.3468	152.058
Powers.			
P. B. M. 16	Is at Powers, Ala., 656 feet above station, on east end of large stone culvert, on first step below coping, north side, being top of copper bolt leaded vertically and marked U. S. P. B. M.	42.1357	138.242
T. B. M. 106	Is a mile below Powers, Ala., 25 feet above milepost 78 from Meridian, 750 feet below bridge No. 157, on base of pine tree, east side of track, being top of spike	38.0073	124.697
T. B. M. 107	Is one-third mile below Cypress, Ala., and three-eighths mile above milepost 77 from Meridian, 740 feet above bridge No. 159, 45 feet east from track, on water oak tree, being top of spike	37.8566	124.202
T. B. M. 109	Is one-third mile below milepost 76 from Meridian, 740 feet above cattle gap and road crossing about 528 feet north of cabin, 45 feet east of center of track, on base of red oak tree, being top of spike	41.3830	135.772
T. B. M. 110	Is one-half mile above Stewarts at the lower end of cut below bridge No. 162 and 740 feet below milepost 75 from Meridian, 45 feet east of center of track, on base of pine tree, being top of spike	40.2669	132.110

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters	Feet.
Stewarts.			
Old B. M. 11	Is at Stewarts, Ala., 50 feet south of Cummings's old gin and 50 feet west of center of track, being spike with washer driven to very approximately the same elevation as old nail, which was gone	39.8301	130.677
	(From this T. B. M. 112 forward, all washers are stamped with the number of the T. B. M.)		
T. B. M. 112	Is 1¼ miles above Akron, Ala., 45 feet east of center of track, opposite milepost 73 from Meridian, on base of large pine tree, being top of spike	36.8611	120.937
T. B. M. 113	Is about 1 mile above Akron, at the south end of bridge No. 167 over Five-mile Creek, at the middle of last bent, east side, on idle pile, being top of spike	36.2626	118.973
Five-mile Creek.			
T. B. M. 114	Is one-fourth mile above Akron, Ala., 308 feet above road crossing, on base of a hollow water oak tree, 60 feet west from center of track, being top of spike	36.8947	121.047
Akron.			
P. B. M. 17	Is in Akron, Ala., on west side of track, opposite the north end of depot, on brick culvert, on top of first brick south of center joint and 1 foot back from west end, being highest point in square	40.1067	131.585
Old B. M.	Is in Akron, Ala., 700 feet west of depot, on Logan Bluff County road, at south side of road, inside field, on base of a large china-berry tree, being top of a railroad spike	38.5450	126.461
T. B. M. 116	Is 1¾ miles below Akron, 3,150 feet below milepost 70 from Meridian, and 615 feet above upper end of bridge, 50 feet west of center of track, on base of pine tree, being top of spike	34.1397	112.006
T. B. M. 118	Is 3 miles below Akron, Ala., 164 feet below lower end of bridge, just above milepost 68 from Meridian, 60 feet east of center of track, on base of a large pine tree, being top of spike	34.7315	113.950
T. B. M. 119	Is 3,115 feet below milepost 68 from Meridian, opposite the lower end of piece of deadened timber, 144 feet below extension of fill to make place for hand car, 55 feet west of center of track, on base of red-oak tree 1 foot in diameter, being top of spike	34.3250	112.616
T. B. M. 121	Is 150 feet above the north end of trestle joining bridge over Warrior River, 75 feet east of track, on post-oak tree 3 feet in diameter, being top of spike	32.3589	106.165
P. B. M. 18	Is at the Warrior River, on Alabama Great Southern R. R., on south end of pier, at the east end of drawspan, on the southwest corner of coping, 10 inches from west face and 8 inches from south face of coping, being top of copper bolt leaded vertically	36.6278	120.171
Warrior River.			
Old B. M. 14	Is on the right bank of the Warrior River, 130 feet above the Alabama Great Southern R. R. bridge and 31 feet back from top of bank, on base of large gum tree, being top of spike, with washer, driven into the old pyramid cut on tree, having no nail	32.7715	107.519
44-foot mark, U. S. gauge, Warrior River.	Is an inclined gauge on slope of right bank of Warrior River, about 150 feet above the Alabama Great Southern R. R.	32.0831	105.260
T. B. M. 122	Is one-third mile west of west end of trestle at Warrior River, on foundation stone of water tank, south side, on the northeast pedestal of the quadrilateral, being highest point of square cut on stone	39.0254	128.037
T. B. M. 123	Is about 2½ miles above Eutaw, Ala., and 490 feet above milepost 64 from Meridian, on top of south end of brick culvert, being highest point in square	36.1582	118.630
T. B. M. 124	Is 1¾ miles above Eutaw, 3,150 feet above milepost 63, from Meridian, just above deep cut on south end of brick culvert, being highest point in square cut on brick	36.4815	119.691
T. B. M. 125	Is about 1 mile above Eutaw, Ala., on east side of track, in line of wire fence, on the third large pine north from the one opposite milepost 63 from Meridian, a distance of 150 feet, being top of spike	43.2840	142.009
P. B. M. 19	Is in Eutaw, Ala., 460 feet below the north side of depot, on coping of brick culvert, north side 4 feet above the south end, about 7 inches back from face, being top of bolt leaded vertically	53.4893	175.491
Eutaw.			
P. B. M. 20	Is in Eutaw, Ala., on Greensborough street, in the northwest corner of Palmer, Banks & Co.'s store, in base stone under window sill, just off from sidewalk, being top of copper bolt leaded vertically	66.2807	217.456

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
T. B. M. 128	Is 1⅜ miles below Entaw, Ala., 2,535 feet below milepost 61 from Meridian, 476 feet below road crossing, 45 feet north of center of track, on base of double hickory tree, being top of spike	49.1849	161.369
T. B. M. 129	Is 2 miles below Entaw, 965 feet below milepost 60 from Meridian, 328 feet above plantation crossing, 30 feet north from center of track, on stump of cedar telegraph pole, being top of spike	49.6232	162,807
T. B. M. 131	Is 3 miles above Hairston, Ala., one-fourth mile above milepost 58 from Meridian and 200 feet above road crossing, on north side of track, on stump of cedar telegraph pole, being top of spike	56.0879	184.017
	SKETCHES BEGIN.		
T. B. M. 132	Is 2¼ miles above Hairston, Ala., 1,875 feet below milepost 58 from Meridian, 572 feet above whistle post, on the southwest quarter of stone culvert, on fourth step from bottom, being highest point in square cut on stone	50.1490	164.532
T. B. M. 134	Is 1¾ miles above Hairston, Ala., 490 feet below Willow Pond road crossing and a quarter mile below milepost 57 from Meridian, 20 feet east of present telegraph pole, on stump of cedar telegraph pole, being top of spike	45.3176	148.681
Hairston. T. B. M. 136	Is in Hairston, Ala., 645 feet below road crossing and 150 feet below cotton-seed shed, 60 feet east from center of main track, on east root of the lone hackberry tree 20 inches in diameter, being top of spike	49.5011	162.407
T. B. M. 138	Is 1¼ miles below Hairston, 515 feet above milepost 54 from Meridian, on the northwest quarter of stone culvert, on fourth step from bottom, being highest point in square cut on stone	40.7510	133.699
T. B. M. 139	Is 1½ miles above Boligee, 3,215 feet below milepost 54 from Meridian, on east end of stone culvert, north side, on second step below coping, being highest point in square cut on stone	37.8086	124.045
T. B. M. 21	Is on same culvert as T. B. M. 139, 1½ miles above Boligee, 3,845 feet above section foreman's house, 3,215 feet below milepost 54 from Meridian, on east end of stone culvert, south side, on second step from top, 10 inches from outer edge and 8 inches from face of stone, being top of copper bolt leaded vertically	37.8089	124.046
T. B. M. 140	Is one half mile above Boligee, 130 feet below road crossing, and 60 feet above section house, 48 feet east from center of track, on base of white oak tree 2 feet in diameter, being top of spike	37.2696	122.277
Boligee. T. B. M. 141	Is in Boligee, 105 feet east of road crossing and 60 feet south from center of track, just east of stores, 24 feet above post-office, on base of large live-oak tree, being top of spike	36.0253	118.194
T. B. M. 142	Is one-half mile west of Boligee, at edge of small piece of woods, 45 feet north of center of track, opposite east end of bridge No. 198, 10 feet east of creek bank, on base of gum tree 1 foot in diameter, being top of spike	35.2582	115.678
T. B. M. 143	Is 1⅜ miles below Boligee, 650 feet above strip of pine woods and 820 feet below milepost 51 from Meridian, 50 feet south from center of track, on base of lone pine tree, 1 foot in diameter, being top of spike	38.2054	125.347
T. B. M. 144	Is about 2 miles below Boligee, 1,725 feet above milepost 50 from Meridian, at edge of woods 50 feet north of center of track, on base of ash tree 18 inches in diameter, being top of spike	36.3367	119.216
T. B. M. 145	Is 2¾ miles below Boligee, Ala., 250 feet above lower edge of woods, 1,800 feet below milepost 50 from Meridian, and 950 feet above plantation-road crossing, 70 feet north from center of track, on base of red-oak tree, 2 feet in diameter, being top of spike	35.1975	115.479
T. B. M. 147	Is about one-half mile above Miller, 720 feet below lower end of bridge No. 202, 100 feet north of center of track, 25 feet from edge of bank made by excavation, on base of sweet-gum tree 18 inches in diameter, being top of spike	31.3509	102.858
Miller. T. B. M. 150	Is 1⅜ miles below Miller, 1¼ miles above Epes, 960 feet above upper end of trestle east of Tombigbee River, at a point of curve of first curve in track above trestle, on top of railroad iron set as a post to mark point of curve, being on surface at southwest quarter of cross cut on iron	34.3340	112.615

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation,	
		Meters.	Feet.
	SKETCHES BEGIN—continued.		
T. B. M. 151	Is on trestle No. 210 joining bridge over the Tombigbee River, 1,230 feet west of its east end at milepost 46 from Meridian, on pile bent No. 93, on north end of cap, being top of spike inside of square cut in timber	33. 9489	111. 382
P. B. M. 22	Is on the east side of Tombigbee River, opposite Epes, Ala., in the east face of east pier of the Alabama Great Southern Railroad Bridge, in the eleventh brick of tie course from south end of pier, and in the fifty-eighth course of brick below the first projecting course at top, being copper bolt leaded horizontally	30. 1316	98. 858
Tombigbee River.			
P. B. M. 23	Is at Epes, Ala., in south end of pier at east end of drawspan, in coping stone, 7 inches from south end and 28 inches from east face, being top of copper bolt leaded vertically	35. 2361	115. 606
T. B. M. 152	Is in Epes, Ala., 40 feet west of depot, on north end of brick culvert, in the middle of the sixth brick from the west face, being highest point in square cut on brick	43. 1955	141. 719
Epes.			
T. B. M. 153	Is about 1 mile west of Epes, Ala., 530 feet below road crossing, at lower end of cut, on south end of the tile culvert, being highest point in square cut on the pipe	49. 6044	162. 745
T. B. M. 154	Is 2 miles below Epes, Ala., 780 feet below milepost 43 from Meridian, a few feet above road crossing and 60 feet south of center of track, being top of spike	60. 2909	197. 806
T. B. M. 156	Is about one-half mile east of Parker, 850 feet below milepost 42 from Meridian, at the upper end of long cut and tangent, at point of curve on south side of track, on surface in the northeast quarter of cross, on top of iron tangent post	73. 3404	240. 620
Parker.			
T. B. M. 157	Is at Parker, Ala., 570 feet south of the north switch stand, on southeast quarter of stone culvert, being highest point in square cut in stone	81. 8606	268. 571
T. B. M. 160	Is 3¼ miles above Livingston, Ala., 1,150 feet above milepost 39 from Meridian, on the southeast corner of brick culvert, being highest point of square	72. 2528	237. 050
T. B. M. 162	Is about 1⅝ miles above Livingston, Ala., 1,740 feet below milepost 38, on west end of brick culvert, on center of first brick north of center joint, being highest point in square cut on brick	55. 9904	183. 697
T. B. M. 164	Is at Livingston, Ala., 189 feet west of the south end of depot and 18 feet from south fence and sheds, on the south side of road leading to town, on base of hickory tree 2 feet in diameter, being top of spike	45. 1666	148. 186
Livingston.			
P. B. M. 24	Is in Livingston, Ala., in the public square on corner of Washington and Market streets, in northeast corner of building for office of the probate judge, on east face 9 inches from corner and in the seventeenth course of brick above the projection at the ground, being copper bolt leaded horizontally	49. 3550	161. 927
P. B. M. 25	Is three-fourths mile below Livingston, on south pier of bridge over the Sucarnochee Creek, on west end of pier on the southeast corner of capstone, 5 inches from north face and 5 inches from the west end, being top of copper bolt leaded vertically	37. 6280	123. 453
Sucarnochee Creek.			
T. B. M. 165	Is 1¼ miles below Livingston, Ala., three-fourths mile south of Sucarnochee Bridge, 250 feet above road crossing at edge of pine woods, 45 feet east of center of track, in base of pine tree 30 inches in diameter, being top of spike	48. 5919	159. 424
T. B. M. 166	Is 2¼ miles below Livingston, 2,475 feet south of milepost 34 from Meridian, at south end of very long cut, 50 feet east from center of track, on base of a yellow pine 30 inches in diameter, being top of spike	52. 0406	170. 738
T. B. M. 167	Is 3¼ miles below Livingston, 460 feet above Sumter Siding, 54 feet east of center of track, at edge of woods, on base of a pine tree 17 inches in diameter, being spike in base	50. 7529	166. 514
Sumter Siding.			
T. B. M. 168	Is 3¾ miles below Livingston and 2,350 feet below Sumter Siding, on top of bank, at cut at edge of woods, about 65 feet east from center of track, opposite whistle post and opposite telegraph pole No. 6860, in base of post-oak tree 30 inches in diameter, being top of spike	52. 8992	173. 555
T. B. M. 169	Is a mile below Sumter Siding, 1,825 feet below milepost 32 from Meridian, 60 feet west from center of track, on base of a pine tree 20 inches in diameter, being top of spike	44. 9878	147. 599

***Description and elevation of precise level bench marks between Birmingham and Meridian*—Continued.**

Number.	Description.	Elevation.	
		Meters.	Feet.
	SKETCHES BEGIN—continued.		
T. B. M. 170	Is 1⅝ miles below Sumter Siding, 150 feet above milepost 31 from Meridian, and 50 feet east of center of track, in base of a pine tree 2 feet in diameter, being top of spike	47.5238	155.920
T. B. M. 171	Is 3½ miles above York, Ala., 3,050 feet below milepost 31 from Meridian and 230 feet below bridge 229, at upper end of cut, 60 feet east of center of track, in base of a pine tree 30 inches in diameter, being top of spike	42.3973	139.100
T. B. M. 172	Is 3 miles above York and 490 feet below milepost 30 from Meridian and section post 43–44, at north end of curve, on tangent post consisting of a piece of railroad iron 5 feet long set 3 feet in ground, being point in the northwest quarter of cross	43.1459	141.556
T. B. M. 173	Is 2¾ miles above York, Ala., 2,185 feet above milepost 29 from Meridian, and 580 feet above road crossing near rail fence, 48 feet west of center of track, on base of a pine tree 24 inches in diameter, being top of spike	47.7017	156.700
T. B. M. 174	Is 1¾ miles above York Station, 2,745 feet below milepost 29 from Meridian, on west bank of creek, running along west side of track, 70 feet from center of track, on east side of wagon road, in base of red-oak tree 2 feet in diameter, being top of spike	44.4021	145.677
T. B. M. 175	Is 1⅛ miles above York, Ala., 615 feet below milepost 28 from Meridian, on the west end of brick culvert, on the sixth brick from the south end, being highest point of square cut in brick	49.3679	161.970
T. B. M. 176	Is one-half mile above York, Ala., 177 feet above road crossing and 190 feet above cabin on west side of road, 63 feet west of center of track, on base of black-gum tree 18 inches in diameter, being top of spike	50.0575	164.232
York. T. B. M. 177	Is in York, Ala., in lower part of town, 315 feet below intersection of Alabama Great Southern and Southern R. R. tracks, 655 feet below York depot, opposite turntable, 60 feet east of track, on top of bank at north end of cut, in base of pine tree 2 feet in diameter, being top of spike	51.2850	168.259
P. B. M. 26	Is in York, Ala., 490 feet below depot and directly below intersection of Alabama Great Southern and Southern R. R. crossing, on east end of stone culvert, south side, on first step below coping, 5 inches from east end and 3½ inches from north face, being top of copper bolt leaded vertically	47.8091	157.052
T. B. M. 179	Is 1⅝ miles below York, Ala., 820 feet above milepost 25 from Meridian, at south end of long tangent beginning at water tank ½ mile below York, at south side of track, on iron tangent post, on point in southeast quarter of cross	49.0649	160.976
T. B. M. 181	Is 3⅛ miles below York Station, 1,660 feet below milepost 24 from Meridian, 1,015 feet below cabin standing at south end of culvert, 81 feet west of center of track, on south root of water-oak tree 10 inches in diameter, being top of spike	51.2525	168.153
T. B. M. 182	Is 3¾ miles below York Station, 230 feet north of milepost 23 from Meridian, on the west end of brick and double-tile culvert, on the center brick between the two tiles, being highest point of square cut in brick	51.3074	168.333
T. B. M. 183	Is 3,215 feet below milepost 23 from Meridian, and 311 feet below plantation road crossing at corner of wood and west edge of small field, 52 feet north of track, in base of pine tree 10 inches in diameter, being top of spike	55.5854	182.368
T. B. M. 184	Is 1¼ miles above Cuba, Ala., 1,310 feet above Cattle Gap, 230 feet below bridge No. 253, at upper end of long cut, 57 feet north of track, on base of sweet-gum tree 16 inches in diameter, being top of spike	59.2423	194.366
T. B. M. 185	Is three-fourths mile above Cuba, Ala., 500 feet above milepost 21 from Meridian, just above upper section house, 52 feet north of center of track, on base of sweet-gum tree 2 feet in diameter, being top of spike	62.4269	204.815
T. B. M. 186	Is in Cuba, Ala., 114 feet below depot, south of track on the north side of south sidewalk in front of Mr. Ward's house, in base of live-oak tree 4 feet in diameter, being top of spike	66.6178	218.564
Cuba. P. B. M. 27	Is in Cuba, Ala., about 400 feet below depot on the rear property line stone of the Alabama Great Southern R. R. Co., 100 feet north of track, in front of Holiness Church and opposite the jug factory, being top of copper bolt leaded vertically in center of stone	65.8519	216.051
T. B. M. 188	Is 1½ miles below Cuba, Ala., 975 feet below milepost 19 from Meridian, at west end of cut around sharp curve, on north end of brick and tile culvert, being highest point in square cut in cement over the centre of tile	73.2848	240.438

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
	SKETCHES BEGIN—continued.		
T. B. M. 189	Is 2¼ miles below Cuba, Ala., in the State of Mississippi, 720 feet west of the State line, 195 feet west of the cattle gap. on elevated bridge, at the east side of plantation road, 52 feet south of center of track, on base of a red-oak tree 30 inches in diameter, being top of spike	82.9763	272.234
T. B. M. 190	Is 2¾ miles below Cuba, Ala., 2,375 feet below milepost 18 from Meridian, at upper edge of pine woods and southwest corner of field, 100 feet above cattle gap and 54 feet north of track, on base of 24-inch pine tree, being top of spike	79.8873	262.100
T. B. M. 191	Is one-half mile above Kewanee, Miss., and three-eighths mile above the water tank, 610 feet below milepost 17 from Meridian, at road crossing and corner of fence, 80 feet south of track, on base of pine tree 18 inches in diameter, being top of spike	83.4136	273.669
Kewanee.			
T. B. M. 193	Is 1 mile below Kewanee, Miss., 715 feet below cattle gap, on elevated point of ground, 66 feet north of center of track, on base of a gum tree 16 inches in diameter, being top of spike	73.7987	242.124
T. B. M. 194	Is about 1½ miles below Kewanee, Miss., opposite milepost 15 from Meridian, at upper end of bridge No. 273, at east side of rail fence east of creek, in base of gum tree 16 inches in diameter, being top of spike	74.3812	244.035
T. B. M. 195	Is 425 feet above east switch stand, at Smith's siding, at corner of fence and northeast corner of field, near clump of trees just above cut, 785 feet above road crossing, 69 feet north of center of track, on base of a gum tree 16 inches in diameter, being top of spike	79.0364	259.305
T. M. B. 197	Is three-fourths of a mile above Toomsuba, Miss., 300 feet above milepost 13 from Meridian, east of dwelling house at west end of small cut, 20 feet south of center of track, on stump of cedar telegraph pole, being top of spike	87.2628	286.295
T. M. B. 198	Is in Toomsuba, Miss., 120 feet north of track, on commons behind depot, in base of lone gum tree 30 inches in diameter, being top of spike	89.5841	293.914
Toomsuba.			
P. B. M. 28	Is in Toomsuba, Miss., 120 feet above the east end of depot, in the fourth brick from the west side of brick culvert running under siding on the north side of track directly opposite T. B. M. 198, being top of copper bolt leaded vertically	89.0388	292.125
T. B. M. 200	Is 1¼ miles below Toomsuba, Miss., 150 feet below road crossing in front of cabin, at east side of road and west of track (track here runs about north and south), in base of a red-oak tree 2 feet in diameter, being top of spike	98.2186	322.242
T. B. M. 201	Is 1⅝ miles below Toomsuba, Miss., 2,030 feet below milepost 11 from Meridian, standing at Beaver's crossing at upper (east) end of long cut, 49 feet north of center of track, in base of a pine tree 10 inches in diameter, being top of spike	102.5006	336.291
T. B. M. 202	Is 2⅜ miles below Toomsuba, Miss., 180 feet above milepost 10 from Meridian, below road crossing and at east end of cut on north bank of ditch, 60 feet north from center of track, in base of triple gum, being top of spike	108.5954	356.257
T. B. M. 203	Is 3 miles below Toomsuba, Miss., 262 feet west of switch stand. at lignite mine, 65 feet south of track, in base of a gum tree 8 inches in diameter, being top of spike	117.6657	386.046
Lignite mine.			
T. B. M. 204	Is 3⅞ miles below Toomsuba, Miss., 990 feet below lower end of switch at mine, at the east end of first cut west of mine, 50 feet south of center of track, on base of pine tree 12 inches in diameter, being top of spike	125.8099	412.765
T. B. M. 205	Is 4½ miles below Toomsuba, Miss., 1,210 feet below milepost 8 from Meridian, in small pine grove, 50 feet north of center of track, on base of a pine tree 12 inches in diameter, being top of spike	134.4542	441.127
T. B. M. 206	Is 1¼ miles above Russell, Miss., 2,045 feet above road crossing, 1,835 feet above milepost 7 from Meridian, and 245 feet above cattle guard, in pine grove at lower end of cut. 66 feet north of center of track, on base of pine tree 12 inches in diameter, being top of spike	129.2490	424.049
T. B. M. 207	Is 1,335 feet below milepost 7 from Meridian, 400 feet above Russell, on the northeast corner of brick culvert under track, being highest point of square cut in cement	126.3424	414.516
Russell.			
T. B. M. 208	Is 3,215 feet below Russell, Miss., 328 feet above milepost 6 from Meridian, 20 feet south of center of track, on stump of cedar telegraph pole, being top of spike	120.1274	394.133

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation	
		Meters.	Feet.
	SKETCHES BEGIN—continued.		
T. B. M. 210	Is five-eighths of a mile above Arklett, Miss., 230 feet below milepost 5 from Meridian, 600 feet below road crossing, 50 feet south of center of track, on root of persimmon tree 5 inches in diameter, being top of spike	112. 0839	367. 783
Arklett.			
T. B. M. 211	Is 1,195 feet above milepost 4 from Meridian and 35 feet above lower switch stand at Arklett, 53 feet south of center of track, opposite wide point in bank for hand car, on base of a large pine tree 20 inches in diameter, being top of spike	109. 3304	358. 699
T. B. M. 212	Is 3.65 miles above depot at Meridian, Miss., 1,460 feet above milepost 3 from Meridian, at corner of woods and old field, 48 feet south of center of track, on base of a gum tree 3 feet in diameter, being top of spike	105. 1728	345. 058
T. B. M. 213	Is 2¼ miles above Meridian depot, Miss., 2,375 feet above milepost 2 from Meridian, at lower end of cut in point of pine woods, 51 feet east of center of track, just south of rail fence, on base of triple persimmon tree 8 inches in diameter, being top of spike	105. 5886	346. 423
T. B. M. 214	Is 1¾ miles above Meridian, Miss. (depot), 1,895 feet below milepost 2 from Meridian, at edge of woods, 57 feet west of center of track, on base of a red oak tree 36 inches in diameter, being top of spike	100. 8990	331. 037
Siawasee Creek.			
T. B. M. 215	Is 1½ miles above Meridian, Miss., at upper end of cut, 175 feet above milepost 1 from Meridian, 45 feet east of center of track, at north side of fence, in root of sweet gum tree 5 inches in diameter, being top of spike	102. 3987	335. 967
T. B. M. 216	Is in Meridian, Miss., opposite the south end of the Interstate Planing Mill, 328 feet below the office, 24 feet east of the Alabama Great Southern track, on stump of cedar telegraph pole, being top of spike	101. 7284	333. 758
T. B. M. 217	Is in Meridian, Miss., at the southeast corner of Fifth street and Twentieth avenue, about 120 feet east of south entrance, on opposite side of street, on curb, 26 feet east of east point of curve, being highest point in square	102. 2916	335. 605
U. S. C. & G. S., B. M., "C."	Is on court-house at Meridian, Lauderdale County, Miss., a cross cut on the iron door sill at the north entrance; is near the east edge of the sill and measures from its center to the extreme north edge of sill 0.32 meters and 0.0445 from the east door jamb, established March, 1884, and marked thus ×	105. 2821	345. 417
Meridian.			
P. B. M. 29	Is in Meridian, Miss., at the south entrance to the post-office building on the west end of door sill stone, 4 inches from west jamb and 3 inches from south face of stone, being top of copper bolt leaded vertically	104. 3060	342. 214
T. B. M. 1	Is on the line of the Southern Railroad, three-fourths of a mile east of York, Ala., at the west end of first trestle on idle pile under track, being top of spike	43. 7721	143. 611
Alamuchee Creek.			
T. B. M. 2	Is 1 mile east of York, Ala., at the east end of bridge over the Alamuchee Creek, north side, on cap over piling 3 feet from end, being top of spike	44. 4595	145. 866
T. B. M. 3	Is 4,940 feet east of the Alamuchee Creek, 425 feet east of trestle and 75 feet north of track, on a new pine stump 24 inches in diameter, being top of spike	43. 3679	142. 284
T. B. M. 4	Is 2¼ miles east of York, Ala., 1,070 feet below milepost 260 N, 300 feet east of cut, 75 feet south of track, on the north root of a red oak tree 3½ feet in diameter, being top of spike	46. 6397	153. 019
T. B. M. 5	Is 1 mile west of Curl Station, 196 feet east of milepost 267-N, 250 feet west of end of long tangent beginning at York, at edge of woods on north side of wagon road, 42 feet north from center of track, on base of red oak tree 15 inches in diameter, being top of spike	53. 4423	175. 337
T. B. M. 6	Is one-half mile west of Curl Station, Ala., 2,410 feet west of milepost 266-N, 400 feet west of cabins on west side of wagon road near crossing and 45 feet south of center of track, on base of a white oak tree 18 inches in diameter, being top of spike	51. 4633	168. 844
Curls.			
T. B. M. 7	Is 590 feet east of depot at Curls, Ala., in little swag between two cuts, 150 feet east of switch stand, 27 feet north of center of track, on base of pine tree 14 inches in diameter, being top of spike	48. 2543	158. 316
T. B. M. 9	Is 1¼ miles east of Curls, Ala., 48 feet east of trestle No. 264.4-N, and 24 feet north from center of track, on gum stump 15 inches in diameter, being top of spike	29. 4756	96. 706

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
Sucarnoochee Creek.	SKETCHES BEGIN—continued.		
T. B. M. 11	Is at the northeast corner of bridge over Sucarnoochee Creek, on the east end of center timber of bridge seat, being top of spike inside of square cut in timber	30. 3782	99. 667
T. B. M. 12	Is 1¼ mile west of Lee, Ala., three-fourths mile east of Sucarnoochee Creek, 120 feet east of Gills Crossing, and 36 feet north of center of track, on top of a pine stump 2 feet in diameter, being top of spike	31. 2122	102. 403
T. B. M. 13	Is nearly a mile west of Lee, Ala., under center of track, under bridge No. 261.3-N, east part, on idle pile, being top of spike	29. 4829	96. 730
T. B. M. 14	Is one-third mile above Lee, Ala., 755 feet west of the west switch stand, 45 feet north of track, on base of pine tree 18 inches in diameter, being top of spike	33. 9344	111. 334
Lee.			
T. B. M. 15	Is three-eighths mile east of Lee Station, 655 feet west of road crossing, 1,080 feet west of viaduct, 39 feet south of track, on base of pine tree 30 inches in diameter, being top of spike	36. 4465	119. 576
T. B. M. 17	Is 1⅝ miles west of Coatopa, Ala., 720 feet west of trestle, at west side of plantation road near crossing, 36 feet south from center of track, on base of pine tree 30 inches in diameter, being top of spike	40. 2496	132. 054
T. B. M. 18	Is five-eighths mile west of Coatopa, Ala., opposite milepost 258-N, and 39 feet north of track, north of fence, in field, on base of a hickory tree 15 inches in diameter, being top of spike	43. 0207	141. 145
T. B. M. 19	Is in Coatopa, Ala., 63 feet east of Parker's store, 49 feet north of center of track, on live oak tree 3 feet in diameter, being top of spike in north root	37. 7280	123. 781
Coatopa.			
P. B. M. 1	Is in Coatopa, Ala., in the southeast corner of Parker's store, in the sixteenth course of brick from ground and sixth from south corner, being copper bolt leaded horizontally	38. 8946	127. 608
T. B. M. 20	Is three-fourths mile east of Coatopa, Ala., 195 feet east of trestle No. 256. 7-N, west of road at crossing, 48 feet north of center of track, at entrance to Mr. Larkin's ground, on base of red-oak tree 27 inches in diameter, being top of spike.	43. 7226	143. 448
T. B. M. 21	Is 1¼ miles east of Coatopa, Ala., at southeast corner of Larkin's Park, 785 feet east of road crossing and 54 feet north of track, on base of 36-inch red-oak tree, being top of spike.	50. 1401	164. 503
T. B. M. 23	Is 2⅜ miles east of Coatopa, at bridge No. 254. 6-N, on sharp curve just east of deep cut, under the northwest corner of bridge, on idle pile, being top of spike	49. 5057	162. 422
T. B. M. 24	Is 1 mile west of Arrington, Ala., 820 feet east of milepost 254-N, at west end of side-hill cut, 57 feet south of center of track, on base of a sassafras tree 15 inches in diameter, being top of spike	38. 8620	127. 501
T. B. M. 25	Is 295 feet west of milepost 253-N, which is at Arrington, on east bank of branch opposite trestle No. 253. 1-N, 89 feet north of center of track, on root of persimmon tree 8 inches in diameter, being top of spike	30. 6072	100. 418
Arrington.			
T. B. M. 26	Is seven-eighths mile east of Arrington, at southwest corner of woods opposite trestle 252. 2-N, 60 feet north from center of track, on base of pine tree 40 inches in diameter, being top of spike	26. 3853	86. 567
T. B. M. 27	Is 1⅝ miles east of Arrington, Ala., 850 feet west of trestle No. 251. 4-N, 30 feet south of track, on stump of cedar telegraph pole, being top of spike	26. 6535	87. 447
T. B. M. 28	Is 3½ miles west of McDowell, Ala., opposite milepost 251-N, 33 feet north of center of track, on base of a twin water-oak tree 30 inches in diameter, being top of spike	25. 3504	83. 171
T. B. M. 29	Is seven-eighths mile west of Halls Creek, 1,840 feet west of milepost 250-N, 50 feet north of track, on base of lone pine tree, 30 inches in diameter, being top of spike	25. 9154	85. 025
T. B. M. 30	Is 600 meters west of Halls Station, 390 feet west of trestle No. 249.7-N, 35 feet north of track, on base of sweet gum tree 8 inches in diameter, being top of spike	25. 3272	83. 095
Halls Creek.			
T. B. M. 31	Is 1¼ miles west of McDowell, 1,360 feet east of east end of bridge over Halls Creek, 50 feet north of track, on base of red oak tree 14 inches in diameter, being top of spike	27. 6943	90. 862
T. B. M. 32	Is three-fourths mile east of Halls Creek, seven-eighths mile west of McDowell, at southwest corner of woods, 120 feet west of whistle post, and 30 feet north of track, on base of pine tree 18 inches in diameter, being top of spike	28. 5895	93. 798

Description and elevation of precise level bench marks between Birmingham and Meridian—Continued.

Number.	Description.	Elevation.	
		Meters.	Feet.
	SKETCHES BEGIN—continued.		
T. B. M. 33	Is three-eighths mile west of McDowell, Ala., 655 feet west of milepost 248-N, 42 feet north of center of track, on base of an 8-inch pine tree standing between two large pines, being top of spike	27.3502	89.732
P. B. M. 2	Is in McDowell, Ala., on pedestal stone of water tank foundation, on the northeast corner of northeast stone of north quadrilateral, 8 inches from east face and 6 inches from north face of stone, being top of copper bolt leaded vertically	29.4692	96.684
McDowell. P. B. M. 3	Is three-fourths mile east of McDowell, Ala., on south end of west pier of bridge over the Tombigbee River, in coping 8 inches from east face, being top of copper bolt leaded vertically	28.5604	93.703
Tombigbee River. P. B. M. 4	Is three-fourths mile east of McDowell, Ala., on north end of east pier of bridge over Tombigbee River, in coping stone, being top of copper bolt leaded vertically	28.5529	93.678
T. B. M. 34	Is at the east end of trestle east of and adjoining the bridge over the Tombigbee River, under south side of bridge, in top of idle pile, being top of spike	26.9700	88.485
T. B. M. 35	Is seven-eighths mile east of east end of trestle adjoining bridge over Tombigbee River, 110 feet west of road crossing and 35 feet north of track, on base of pine tree 18 inches in diameter, being top of spike	25.5313	83.765
T. B. M. 36	Is 2¼ miles east of the east end of trestle adjoining bridge over Tombigbee River, 315 feet west of milepost 245-N, 63 feet south of track, on base of pine tree 16 inches in diameter, being top of spike	26.6235	87.348
T. B. M. 37	Is 1⅜ miles west of station at Demopolis, Ala., 475 feet west of trestle 244.3-N, at low spot of ground, on root of a cottonwood tree 14 inches in diameter, 2 feet from body of tree, being top of spike	28.1436	92.335
T. B. M. 39	Is at lower end of Demopolis, Ala., south of graveyard, 120 feet east of trestle 243.4-N, over Foss Creek, 90 feet west of road crossing, 35 feet south from center of track, on base of elm tree 8 inches in diameter, being top of spike	31.7931	104.309
T. B. M. 40	Is in Demopolis, Ala., in front of passenger depot and in front of the Lister House, 22 feet south of track, on base of lone cedar tree 22 inches in diameter, being top of spike	34.0762	111.800
Old B. M	Is in Demopolis, Ala., on Washington street, opposite the fire department station, at the front entrance to Demopolis Inn, on east end of iron doorsill (this was formerly the Royal Hotel), on raised letters cast on sill, "Progress Manf'g Co., Meridian, Miss.;" the point taken is the center of the arc C.	37.0552	121.573
P. B. M. 5	Is in Demopolis, Ala., on the southeast corner of Walnut and Capitol streets, on the northwest corner of the Mayer Block, on north end of base stone, under north window, 6¼ inches above sidewalk and 6¼ inches south of buttress, being top of copper bolt leaded vertically	38.8289	127.393
Demopolis. P. B. M. 6	Is in Demopolis, Ala., on the northeast corner of Washington and Strawberry streets, on the southeast corner of Cheshire Webb Building, on east end of base stone under window east of east entrance, 6 inches above sidewalk, being top of copper bolt leaded vertically	39.1372	128.404

S 18.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

The schooner *Robert H. Rathburn*, loaded with lumber was burned and sunk in Pascagoula Harbor, Mississippi, on the 20th day of May, 1898, and reported as dangerous to navigation June 1, 1898. An allotment was made by indorsement of Chief of Engineers, U. S. A., dated July 6, 1898, of $1,500 for removal of this wreck. Advertisement was made for bids for the work, and were opened at this office October 28, 1898. W. Chase Spotswood of Mobile was the only bidder. His bid was $2,000, and being considered too high was recommended for rejection. An oral agreement was then made with Mr. Spotswood, by the terms of which he is to make an attempt to remove the wreck, carrying it into deep water of the Gulf of Mexico and sink it for the sum of $1,400, which sum it has been agreed to pay him if he succeeds, and if he fails he is to receive nothing.

No work was done prior to the close of the fiscal year. Mr. Spotswood is now arranging to remove the wreck.

A wooden side dump scow and a wooden barge were sunk in Mobile River opposite foot of Adams street, Mobile, Ala., some years ago, exact date unknown, and were reported as being an obstruction to navigation on January 24, 1899.

An allotment of $600 was made by letter of the Chief of Engineers, U. S. A., dated April 8, 1899, for the removal of both wrecks. Advertisement was made for bids for the work, and were opened at this office at noon May 24, 1899. The lowest bid was made by Rufus K. Merrill. His bid was $489 for removal of both wrecks, and was recommended for acceptance. Before this bid was approved by the Chief of Engineers and contract could be made for the work, Mr. B. Roberts, of Mobile, Ala., claimed the wooden barge as his property, stating he would remove the same. The barge has been entirely removed, and the bid of Rufus K. Merrill canceled by indorsement of the Chief of Engineers, dated June 22, 1899. Readvertisement was made for bids for removal of the remaining side-dump scow and are to be opened July 7, 1899.

S 19.

SURVEY OF HORN ISLAND PASS AND HARBOR, MISSISSIPPI.

[Printed in House Doc. No. 51, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1898.

SIR: Congress, by act approved May 7, 1898, provided as follows:

> That the Secretary of War be, and he is hereby, authorized and directed to cause to be made a survey of the pass leading from the Gulf of Mexico into Horn Island Harbor, Mississippi, and a survey of said harbor and of the channel leading to and from said pass, with a view of ascertaining the extent to which the same should be dredged and improved in order to meet the necessities of commerce; and he shall also report a plan for making the necessary dredging and improvements, together with an estimate of the cost of same, and whether or not, in the opinion of the War Department, the proposed improvement should be undertaken by the Government.

The duty of making the survey and preparing the plan and estimate required by this act was assigned to Maj. William T. Rossell, Corps of Engineers, and I have now the honor to submit the accompanying copy of that officer's report of August 29, 1898, with two maps[1] upon the subject.

He states that there is a depth of 19 feet at mean low water over the shoal at the outer bar, but that a channel there can not be permanently improved by dredging. He is, however, of opinion that any improvement of the anchorage at Horn Island warranted by the present available depth across the outer bar is worthy of being undertaken by the General Government if there is a fair prospect of the same being reasonably permanent. He accordingly submits an estimate, amounting to $50,000, as the cost of the required dredging to secure an anchorage at Horn Island 20 feet deep at mean low water, and states that, in view of the probability of the improvement of the anchorage being reasonably permanent, it is his opinion that the work should be undertaken by the Government. I concur in Major Rossell's views.

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[1] Not reprinted. Printed in House Doc. No. 51, Fifty-fifth Congress, third session.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJOR WM. T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., August 29, 1898.

GENERAL: I have the honor to report as follows on survey of Horn Island Harbor, Mississippi, as provided for by act approved May 7, 1898. The law reads as follows:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of War be, and he is hereby, authorized and directed to cause to be made a survey of the pass leading from the Gulf of Mexico into Horn Island Harbor, Mississippi, and a survey of said harbor and of the channel leading to and from said pass, with a view of ascertaining the extent to which the same should be dredged and improved in order to meet the necessities of commerce; and he shall also report a plan for making the necessary dredging and improvements, together with an estimate of the cost of same, and whether or not, in the opinion of the War Department, the proposed improvement should be undertaken by the Government.

To gather the information necessary to make the report required by this law, I organized a survey party and finished field work during the week ending June 25, 1898. I wrote to the Commercial Club of Pascagoula, Miss., for such data as they could obtain as to the commerce to be affected by any work done at Horn Island Harbor.

From my survey I find that there is at present a depth of water of 19 feet at mean low water over the outer bar. That north of the island there is a fine anchorage, with a least depth of 20 feet, and varying in width from 500 to 2,000 feet, except at two points. In one of these places the width is about 100 feet, and at the other the depth of water is less than 20 feet for a distance of 1,000 feet.

The shoal over the outer bar was surveyed under my direction in October, 1896, and at that time it had a least depth of 18.7 feet at mean low water. In the spring of 1897 a channel was dredged through this shoal 200 feet wide and 1,300 feet long, giving an average depth of 20.5 feet. Between the time of finishing this contract and making the last survey, about one and a quarter years, this channel shoaled to 19 feet at mean low water, or three-tenths of a foot more than existed before dredging was done. During this time there was no exceptionally severe storm, and I think it fair to assume that under ordinary weather this channel over the outer bar can not be permanently improved by dredging. The material composing the bar is fine white sand, easily moved.

On Coast Survey charts of Horn Island Pass and anchorage it is stated that the pass shifts frequently. It is also stated that the average height of tide is 1.4 feet. I inclose herewith a copy of the commercial statistics furnished me by the Commercial Club at Pascagoula, Miss. In view of the large lumber interests at that point, and that Horn Island anchorage is the nearest harbor to that point, I am of the opinion that any improvement in the anchorage warranted by the present available depth across the outer bar should be undertaken by the Government if there is a fair prospect of the same being reasonably permanent. The material in the bottom at the anchorage is reported to be mud and sand in about equal parts. This material, in the position it occupies, is favorable for holding an increased depth if dredged. A depth of 20 feet at mean low water in the anchorage will allow vessels to load to as deep a draft as they can carry over the outer bar at high water.

To gain this depth in the anchorage will require dredging at two points, aggregating about 200,000 cubic yards of material. The material dredged should be dumped at sea, making quite a long tow.

Including all expenses, I estimate that it will cost $50,000 to cut channels at these two places, 500 feet wide and 20 feet deep at mean low water.

I would recapitulate as follows:

First. "A survey of the pass leading from the Gulf of Mexico into Horn Island Harbor, Mississippi, and a survey of said harbor and of the channel leading to and from said pass." This has been done, and two maps made from same are herewith inclosed.

Second. "A plan for making the necessary dredging and improvements, together with an estimate of the cost of the same" (in order to meet the necessities of commerce). The necessities of such commerce as can gain access to Horn Island Harbor will be met by dredging two channels as shown on accompanying maps, at an estimated cost of $50,000. Any improvement by dredging on the outer bar will be temporary.

Third. "Whether or not, in the opinion of the War Department, the proposed improvement should be undertaken by the Government." In view of the amount of commerce and the probability of the improvement of the anchorage being reasonably permanent, it is my opinion that it should be undertaken by the Government.

Respectfully submitted.

WM. T. ROSSELL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

Commercial statistics for the port of Pascagoula, Miss., for the fiscal year ending Jun 30, 1898.

	Number.	Tonnage.
Number of vessels cleared to foreign ports at port of Pascagoula	160	89,636
Number of vessels cleared to domestic ports at port of Pascagoula	61	24,178
Total	221	113,814

Commercial statistics for the port of Pascagoula, Miss.—Continued.

EXPORTS—FOREIGN.

	Quantity.	Value.
Lumber manufactured at and cleared through port of Pascagoula, via Horn Island Harbor ....sup. feet..	45,544,822	$507,612
Timber sawn, manufactured at, and cleared through port of Pascagoula, via Horn Island Harbor ....sup. feet..	13,559,572	114,572
Timber hewn, manufactured at, and cleared through port of Pascagoula, via Horn Island Harbor ....sup. feet..	6,398,330	62,899
Total ....do....	65,502,224	685,083
Lumber manufactured at port of Pascagoula and cleared through port of Biloxi, via Ship Island Harbor ....sup. feet..	10,925,814	136,817
Timber sawn, manufactured at port of Pascagoula, and cleared through port of Biloxi, via Ship Island Harbor ....sup. feet..	12,658,216	111,914
Timber hewn, manufactured at port of Pascagoula, and cleared through port of Biloxi, via Ship Island Harbor ....sup. feet..	3,948,886	36,778
Total ....do....	27,532,916	285,509

EXPORTS—DOMESTIC.

Lumber manufactured at and cleared through port of Pascagoula..sup. feet..	19,119,566	190,360
Lumber manufactured at and shipped in local vessels (not listed in customhouse) ....sup. feet..	13,500,000	135,000
Lumber manufactured at Pascagoula and shipped by rail ....do....	10,500,000	84,000
Total ....do....	43,119,566	409,360
Grand total of lumber and timber manufactured and shipped from Pascagoula, foreign and domestic ....sup. feet..	136,154,706	1,379,952

MISCELLANEOUS.

Lumber and piles (creosoted) by rail ....superficial feet..	2,272,325	$90,893
Packing cases ....number..	12,000	800
Boxes fruit and vegetables ....do....	4,800	300
Rosin ....barrels..	25,000	75,000
Spirits turpentine ....do....	5,000	75,000
Charcoal ....do....	400,000	40,000
Fish ....do....	1,250	8,750
Oysters ....do....	10,000	20,000
Wool ....pounds..	30,000	4,500
Total	....	315,243

S 20.

SURVEY FOR CHANNEL THROUGH SHIP ISLAND PASS, AND FROM SHIP ISLAND HARBOR TO GULFPORT AND TO BILOXI, IN THE MISSISSIPPI SOUND.

[Printed in House Doc. No. 120, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 31, 1898.

SIR: By act of Congress approved June 16, 1898, the Secretary of War is authorized and directed to cause to be made a survey for a channel leading from Ship Island Harbor, Mississippi, to the railroad pier at Gulfport, Miss., and from Ship Island Harbor to Biloxi, Miss., and also for an anchorage basin at both places, with a view to ascertaining the cost of the same and its advisability; he is also required to report a place [plan] for making and maintaining said channels and basins by necessary dredging and improvements, together with an estimate of the cost of same, and to make a survey for a channel 26 feet deep at mean low water through Ship Island Pass, Mississippi, and report the cost and advisability of making same by dredging.

The duty of making the surveys and preparing plans and estimates contemplated by this act was assigned to Maj. W. T. Rossell, Corps of Engineers, and I have now the honor to submit the accompanying copy of that officer's report of December 17, 1898, upon the subject. The report is accompanied by a map showing the lines of the proposed channels from Ship Island to Gulfport and Biloxi, with anchorage basins, and the proposed channel through Ship Island Pass. Major Rossell states that at Biloxi the anchorage basin may be placed either in front of the town or in the back bay. He submits for this item alternative estimates, and expresses a preference for the location in back bay.

The waterway proposed should, in his opinion, be made 300 feet wide at bottom, and the estimated cost of dredging channels of this width with depths of 17, 19, and 23 feet, respectively, is as follows:

From Ship Island Harbor to Gulfport.

Channel 17 feet deep and 300 feet wide	$371,839.00
Channel 19 feet deep and 300 feet wide	573,967.94
Channel 23 feet deep and 300 feet wide	1,089,627.63

From Ship Island Harbor to anchorage basin in front bay at Biloxi.

Channel 17 feet deep and 300 feet wide	$496,924.35
Channel 19 feet deep and 300 feet wide	766,728.30
Channel 23 feet deep and 300 feet wide	1,586,559.01

From Ship Island Harbor to anchorage basin in back bay at Biloxi.

Channel 17 feet deep and 300 feet wide	$977,730.00
Channel 19 feet deep and 300 feet wide	1,439,198.28
Channel 23 feet deep and 300 feet wide	2,568,134.40

The maintenance of these channels after they have once been obtained will, it is estimated, cost—

For channel to Gulfport	$25,000.00
For channel to front bay, Biloxi	40,000.00
For channel to back bay, Biloxi	60,000.00

The following are the estimates submitted by Major Rossell for obtaining the proposed anchorage basins, the dimensions being 2,640 feet by 1,320 feet:

Depth.	At Gulfport.	At Biloxi.	
		Front bay.	Back bay.
17 feet	$138,296.70	$172,325.14	$166,836.02
19 feet	174,142.02	208,347.49	203,184.41
23 feet	245,432.33	272,828.00	277,196.61

In this connection it is proper to mention the fact that the law chartering the Gulf and Ship Island Railroad confers upon that company the power and authority to reclaim submerged lands of Mississippi Sound for a distance of one-half mile in either direction, east and west from the point of intersection of said line of railroad with the

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Not reprinted. Printed in House Doc. No. 120, Fifty-fifth Congress, third session.

waters of the sound, extending 6 miles from the shore of the present mainland. The railroad company having authority to reclaim this land, the propriety of dredging within that area at public expense is at least questionable.

The channel proposed through Ship Island Pass is to have a depth of 26 feet at mean low water, and the dredging required to secure such a channel will, it is estimated, cost $40,000. Major Rossell is of opinion that this last-mentioned channel if dredged will be reasonably permanent, and that it is advisable to do this work. I concur in his views.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJ. WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., December 17, 1898.

GENERAL: A survey of channel from Ship Island Harbor, Mississippi, to Gulfport and Biloxi, Miss., and of the channel through Ship Island Pass, Mississippi, was required by the following law, approved June 16, 1898:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of War be, and he is hereby, authorized and directed to cause to be made a survey for a channel leading from Ship Island Harbor, Mississippi, to the railroad pier at Gulf Port, Mississippi, and from Ship Island Harbor to Biloxi, Mississippi, and also for an anchorage basin at both places, with a view to ascertaining the cost of same and its advisability.
>
> He shall also report a place for making and maintaining said channels and basins by necessary dredging and improvements, together with an estimate of the cost of same. He shall further cause to be made a survey for a channel twenty-six feet deep at mean low water through Ship Island Pass, Mississippi, and report the cost and advisability of making same by dredging.

I was charged with the duty of making this survey by letter from the Chief of Engineers, United States Army, dated July 25, 1898.

Owing to the threatened yellow fever I put off making this survey until November. A party was then organized and put in the field. Work on this survey was continued until December 19, 1898. Owing to storms and bad weather the amount of information gathered during this time is not as great as I had hoped it would be.

The law requires a report as to the place for making and maintaining channels from Ship Island, Mississippi, to the railroad pier at Gulfport, Miss., and from Ship Island Harbor, Mississippi, to Biloxi, Miss., and and also for anchorage basins at both places.

The place that seems best for a channel from Ship Island Harbor to railroad pier at Gulfport is a straight line, as shown on the accompanying chart, with basin just outside of the pier. I have made the basin one-quarter of a mile wide and one-half of a mile long, with side slopes of one on five. This will, in my opinion, be ample for all present needs. The channel I propose to make 300 feet wide at the bottom, with side slopes of one on thirty. At Biloxi the basin may be either placed in front of the town or in the back bay. I am of the opinion that the back bay is the best.

The following tables give the length, yardage, and estimated cost of these channels and basins:

Channel.			From Ship Island Harbor to—								
			(*a*) End of R. R. pier, Gulfport, Miss.			(*b*) Anchorage basin front bay, Biloxi.			(*c*) Anchorage basin back bay, Biloxi.		
Depth.	Width.	Side slopes.	Miles.	Cubic yards.	Cost.	Miles.	Cubic yards.	Cost.	Miles.	Cubic yards.	Cost.
Ft.	*Ft.*										
17	300	1 on 30 feet	6.5	2,860,300	$371,839.00	8.4	3,822,495	$496,924.35	12.6	7,521,000	$977,730.00
19	300	1 on 30 feet	7.3	4,415,138	573,967.94	9.5	5,897,910	766,728.30	16.8	11,070,756	1,439,198.28
23	300	1 on 30 feet	11.3	8,381,751	1,089,627.63	14.8	12,204,377	1,586,569.01	21.7	19,754,880	2,568,134.40

Cost of removal of material is estimated at 13 cents per cubic yard.

I estimate the cost of maintaining channel to Gulfport, if dredged, at $25,000; to front bay, Biloxi, if dredged, at $40,000; to back bay, Biloxi, if dredged, at $60,000.

For anchorage basins at above points, as folllows:

Depth.	Dimensions.	Slopes.	Location.					
			Gulfport.		Front bay, Biloxi.		Back bay, Biloxi.	
			Cubic yards.	Cost.	Cubic yards.	Cost.	Cubic yards.	Cost.
Ft.	*Ft.*							
17	2,640 by 1,320	1 on 5 feet	1,063,821	$138,296.73	1,325,578	$172,325.14	1,283,854	$166,836.02
19	2,640 by 1,320	1 on 5 feet	1,339,554	174,142.02	1,602,673	208,347.49	1,502,957	203,184.41
23	2,640 by 1,320	1 on 5 feet	1,887,941	245,432.33	2,175,600	272,828.00	2,132,297	277,198.61

Cost of removal of material is estimated at 13 cents per cubic yard.

It will be noted that the law requires no report as to the advisability of making either or both these channels. But as the first paragraph of the law states that the survey is to be made with a view to ascertaining the advisability of making these channels and basins, I have gathered such data on the subject as I could, and forward the papers bearing on this with my report.

In this connection, I call attention to the following paragraph of the law chartering the Gulf and Ship Island Railroad:

> SEC. 17. *Be it further enacted*, That the right, power, and authority to reclaim the submerged lands of said Mississippi Sound, for a distance of one-half mile in either direction, east and west, from the point of intersection of said line of railroad with the waters of said sound, extending six miles from the shore of the present mainland, in a southerly direction, to take, have, and to hold said lands so reclaimed, and to enjoy, use, and control the same to especial use and benefit of said company; to lease, re-lease, sell, convey, mortgage, or otherwise dispose of the same; to locate, construct and thereafter to maintain, and use suitable wharves, piers, breakwaters, basins and depots, or other appurtenances, appendages, and buildings thereon and proper for the loading and unloading, receiving, and discharging freight and passengers from seagoing, lightering, and coasting vessels.

This would seem to fix the harbor lines at Gulfport at a distance of 6 miles from the shore. It has not been the custom of the United States to dredge channels or basins inside of the harbor lines.

The second part of the second paragraph of the law requires an estimate as to cost and report as to advisability of dredging a channel through Ship Island Pass with a depth of 26 feet at mean low water. The line proposed is shown on the sketch, and it will require the removal of 160,000 cubic yards, and I estimate that this work can be done for 25 cents per cubic yard, making the cost $40,000.

The bar seems to be composed of a comparatively stiff clay, and there seems to be a probability that the channel, if dredged, will be reasonably permanent. On this account, and in view of the excellent harbor to which it is the outlet and the fact that it is the best harbor on the coast of Mississippi, I believe that it is advisable to do this work.

Respectfully submitted.

WM. T. ROSSELL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Baltimore, Md., December 27, 1898.

Respectfully submitted to the Chief of Engineers.

The report of the district engineer seems to cover all the points in the case, so that there is nothing to be added, except possibly to call attention to the fact that it is not only not customary for the United States to dredge inside of harbor lines, but that the law actually forbids it.

PETER C. HAINS,
Colonel, Corps of Engineers,
Division Engineer, Southeast Division.

RESOLUTION OF THE BOARD OF SUPERVISORS OF MARSHALL COUNTY, MISS., PASSED AT DECEMBER TERM, 1898.

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State; and whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Marshall, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

STATE OF MISSISSIPPI, *Marshall County:*

I, Sam H. Pryor, clerk of the chancery court of Marshall County and clerk of the board of supervisors of said county and State, certify that the foregoing is a true copy of a resolution passed at the December term of the board of supervisors, as shown in Minute Book 14, page 136.

SAM H. PRYOR,
Clerk of Board of Supervisors.

[Seal of board of supervisors.]
[Seal of chancery court.]
[Revenue stamp.]

LETTER OF COMMITTEE REPRESENTING THE DEEP-WATER HARBOR CONVENTION.

JACKSON, MISS., *December 10, 1898.*

The undersigned, appointed by the Deep-water Harbor Convention, which convened at Hattiesburg on the 25th day of November, 1898, as a committee to collect and submit to you statistics as to the territory, products, and tonnage from the present terminus of the Gulf and Ship Island Railroad at Gulfport to the northern boundary of the State, respectfully present the following:

We have caused to be made a careful canvass of that portion of the territory which would be traversed by this line in the counties of Perry, west Jones, west Jasper, Smith, Covington, Lawrence, Simpson, and Marion, and find that there is raised in the above area, and which is tributary to the proposed line, a total of 56,840 bales or 27,210,000 pounds of cotton, in verification of which we herewith append, marked Exhibit A, a detailed statement of the name and post-office address of each ginner in the above territory, together with the number of bales handled at each gin. The figures here given are accurate, and we invite investigation and verification thereof.

As to the territory tributary to the proposed line and lying north of the Alabama and Vicksburg Railway we have been forced to make estimates, which we herewith submit in schedule marked Exhibit B, and which, though not absolutely exact, are sufficiently accurate as estimates to form the basis of a report and to give a clear idea of the tonnage which would seek an outlet through Ship Island Harbor.

We have made these estimates on very conservative lines, and have no hesitancy in saying that the exact figures will be considerably in excess of those herein given. We are certain that they will not fall below our calculations.

In addition to this we submit, in a paper marked Exhibit C, an estimate of the stumpage in the shape of pine and hard-wood timber lying along the proposed line of this road and between the Alabama and Vicksburg Railway and Gulfport. This estimate we have made upon a basis of 4,000 feet to the acre, which is about 25 per cent below the estimate given by the best-informed mill men in that section. In verification of this fact we submit a number of letters from the largest and best-posted mill men in that territory. We have made no estimates as to the stumpage between the line of the Alabama and Vicksburg Railway and the northern boundary of the State, for the reason that the time given us in which to gather this data is so short that we are unable to gather any figures for which we are willing to vouch. Dealing in generalities, we have no hesitancy in saying that the amount of pine and hard wood within that area exceeds considerably the stumpage given above.

Referring to naval stores, our estimates apply only to territory south of the Alabama and Vicksburg Railway. You will get this under the head Exhibit D. You will also find attached thereto estimates from practical turpentine men which will verify this statement.

We have also caused to be prepared, and hand you herewith, a certificate from the office of the auditor of public accounts showing the assessed taxable values in the territory which would be traversed by and tributary to a road built along the proposed line of the present Gulf and Ship Island Railroad. This certificate is a copy of the official records and was made from the assessment rolls of the year 1896, or before the completion of the Ship Island Railroad to its present northern terminal, Hattiesburg. A conservative estimate of the accrued values along the line from Gulfport to Hattiesburg leads us to say unhesitatingly that the increased values to-day are fully 100 per cent more.

The completion of the road north, it is reasonable to suppose, would increase values in the same proportion. In other words, referring to the auditor's report, which is a copy of the assessment roll, we find the total valuation of properties to be $17,830,578.60. Applying the same proportional increase that is shown on the present line of the Gulf and Ship Island Railroad to Hattiesburg, this alone would double the assessment rolls in the State along this territory.

Of course, the incoming freight from this territory is as important and almost as great as the outgoing. In the one item of fertilizer, which is freely used throughout the entire belt, about 300 pounds is required for the production of each bale of cotton, or 40,650 tons for the entire belt along the proposed line.

The average cost of hauling this fertilizer from the railroad to the consumer is about $6 a ton, and for verification of this we refer you to letters from merchants in the interior. At $6 per ton, cost of hauling, you will find that the people in this territory are put to the burdensome expense of $243,900 annually for hauling their fertilizer.

It goes without saying that the cost of hauling every other item of incoming freight which the producer needs is proportionate. As great as the figures are given on fertilizer in the area above-mentioned there are 135,500 tons of cotton seed annually raised, all of which could be exported, save about 10 per cent retained for planting. The cost of hauling this product under present railroad facilities is practically prohibitory and the whole crop practically wasted.

This item alone means an annual loss of $813,000 to the people of this section of the country, estimating the value received at $6 a ton.

The above constitutes the only accurate data which this committee has been able to gather in the limited time assigned for the performance of its duty. We trust it may be of some service in arriving at your conclusions and formulating your report.

To summarize the different exhibits, we find the following tonnage:

	Tons.
Cotton	64, 362
Cotton seed	107, 000
Naval stores	1, 059, 840
Timber	381, 542, 400
Total	382, 773, 602

Respectfully submitted.

J. M. PHILLIPS.
W. N. NASH.
J. S. HAMILTON.
J. H. HINTON.
GEO. S. GARDINER.
J. W. T. FAULKNER.

WM. T. ROSSELL, *Major of Engineers, U. S. A.*

EXHIBIT A.

Cotton statistics for territory south of Alabama and Vicksburg Railway.

Name of ginner.	Post-office address.	Number of bales.	Estimated number of pounds.
John Alexander	Estabutchie	100	475
R. F. Lowry	Wheelerville	150	475
F. M. Morris	Morriston	200	475
Andrew Harrington	Curtis	200	475
Pink Reynolds	McDonalds Mill	100	475
Mr. Wallis	Napier	150	475
William Morris	Welch	150	475
W. A. Fairchild	do	200	475
J. N. Welsh	do	250	475
Dan Knight	Dont	200	475
George Ponds	Oakohay	250	475
William Roberts	Reddoch	250	475
Price & Pritchett	do	275	475
Willis McLemore	Coat	250	475
Dorris Knight	do	200	475
John Murray	Oakohay	400	475
——— Hughes	do	200	475
J. S. Eaton	Taylorsville	200	475
W. E. Cargile	do	75	475
J. B. Ford	do	125	475
A. Keys	do	65	475
J. H. Ford	do	150	475
Will Dorris & Bro	Summerland	250	475
J. D. Gambrell	Ford	300	475
S. S. Stringer	Stringer	150	475
J. W. Grissom	do	125	475
Rufus Eddings	Otos	200	475
Blankenship & Thigpen	Lake Como	400	475
Blankenship & Denson	Bay Springs	500	475
Cook & Fail	Lake Como	250	475
W. F. Windom	Turnerville	150	475
J. A. Brown	Hamlet	150	475
J. H. Eddings	Shadygrove	150	475
William South	do	250	475
Ed. McLaurin	Ted	300	475
W. C. Blackwell	Sylvarena	350	475
Boyd Gin Company	Ford	300	475
Pitman Gin Company	Boykins	300	475
J. W. Lewis	Pineville	50	475
S. R. McLaurin	Boyer	200	475
R. T. Robertson	Raleigh	500	475
J. F. Smith & Co	do	300	475
R. J. Butler	do	250	475
L. M. Kelly	do	225	475
W. D. Barnes	Princeville	400	475
W. R. Vaughan	do	400	475
J. B. Limbough	Burns	500	475
Derrick & Epting	do	850	475
Heywood & George	Lemon	500	475
Heywood & Walker	do	300	475
R. J. Little	Trenton	500	475
J. H. Gunn	do	350	475
L. Kelly	do	250	475
Boykin & Dewick	do	400	475
J. A. Thompson	do	350	475
H. Cook	do	300	475

EXHIBIT A—Continued.

Name of ginner.	Post-office address.	Number of bales.	Estimated number of pounds.
V. Russell	Daniel	800	475
Mrs. Baugh	Polkville	600	475
Ike Garner	Raleigh	400	475
J. F. Bowling	Royal	200	475
F. A. Canley	do	300	475
Mr. Dean	Bunker Hill	400	475
Ed. McCollum	do	500	475
Mr. Gentry	do	500	475
Ainsworth & McAlpine	Waco	500	475
Mrs. P. C. Thornton	Faroe	400	475
Cooper Bryant	do	400	475
F. M. Sellars	Andrew	400	475
Meadows & Ward	do	300	475
B. O. Watson	Virgil	500	475
Patrick Bros	do	800	475
Robinson & Jones	Mayton	600	475
T. B. Concey	Johns	700	475
John Tucker	Cato	800	475
A. Burnham	Pusket	600	475
S. R. McLaurin	Boyer	500	475
Chandler & Garner	do	400	475
J. C. D. Rogers	do	200	475
W. F. Bryant		300	475
J. L. Ainsworth	Hissop	500	475
Russell & Bryant	Boyer	350	475
Asa Johnson	Curries	150	475
Hughes & Sellars	Ivy	300	475
E. Burnham	Magee	600	475
John Magee	Coat	150	475
J. L. Duckworth	Vest	300	475
Hugh Walker	Rials	550	475
John White	Coat	400	475
J. D. Ashley	Westville	1,000	475
J. M. Bishop	do	300	475
J. M. Burnham	do	400	475
Hugh Wethersby	Carraway	300	475
F. G. Ponder	Asha	350	475
J. F. Bland	Everett	200	475
John Summer	Vest	300	475
J. R. White	Jaynesville	300	475
W. J. Hubbard	do	300	475
J. R. Polk	Gwinville	300	475
J. A. McNair	Mt. Olive	200	475
A. M. Griffith	Semlin	200	475
Dale, Meyers & Lee	Hebron	300	475
Berry & Butler	do	400	475
J. D. Weathersby	do	250	475
Thompson Bros	Grange	450	475
L. Meyers	Hebron	250	475
S. S. Dale	Mount Carmel	500	475
Isaac Newton	do	300	475
Cole & Griffith	White Sand	450	475
Williams & Co	Silver Creek	400	475
D. Hartzog	do	250	475
Jesse Armstrong	do	400	475
Leon Rogers	Arm	200	475
Fortenberry Bros	do	300	475
Armstrong	do	500	475
G. W. Johnston	Hooker	300	475
R. L. Berry & Bro	Blountsville	150	475
J. S. Bozeman	do	500	475
John Laird	do	250	475
V. C. Atwood	do	400	475
Noah Heniby	do	250	475
W. W. Graves	Mount Carmel	600	475
J. M. McRaney	do	450	475
Lamon McGee	do	300	475
J. M. Polk	do	500	475
John Baker	do	300	475
R. A. Campbell	Powell	450	475
D C. McInnis	Flem	850	475
Ben Leonard	Mount Olive	100	475
J. B. Rogers	Ora	250	475
Wm. M. Bizland	do	200	475
B. M. Rogers	do	150	475
Odum & Colter	Williamsburg	100	475
W. L. Strahan	do	350	475
M. Faler	do	200	475
F. S. Rawls	Sanford	150	475
L. Speed	Williamsburg	75	475

EXHIBIT A—Continued.

Name of ginner.	Post-office address.	Number of bales.	Estimated number of pounds.
Watts Bros	Richmond	300	475
Lott & Altman	do	300	475
Clark & Son	do	200	475
Dan Sumrall & Son	Sumrall	125	475
David ———	Seminary	300	475
Jim Kelly	do	200	475
W. K. Rhodes	do	100	475
D. R. King	Santee	600	475
A. E. Bass	Bassfield	700	475
I. A. Blackburn	Santee	200	475
W. T. Bufkin	Wilkesburg	300	475
J. T. Allen	do	200	475
J. E. Bass		300	475
S. W. Hammond		300	475
L. J. Smith	Wilkesburg	150	475
Carter & Watts	Societyhill	400	475
John Dale	Dale	400	475
Jesse Brown	Burnham	300	475
W. R. Brown	do	200	475
Ed. Taylor	Oakvale	200	475
W. J. Armstrong	Arm	400	475
J. D. Burket	do	300	475
H. H. Bonner		300	475
J. A. Ball	Columbia	350	475
N. W. Bayliss	do	350	475
T. J. Rondin	do	200	475
T. W. Foxworth	do	350	475
E. Summers	do	400	475
J. A. Burt	do	300	475
E. O. Ball	do	150	475
W. W. Maja	do	150	475
Martin Bros	do	100	475
Wm. Hopgood		800	475
W. M. Hartsford	Ola	150	475
A. Burch	do	200	475
Lambert & Bart	Felix	100	475
W. M. Burch	Hattiesburg	200	
C. E. Rich	do	500	
C. W. Smith	do	200	
Mr. Trost	do	100	
Augusta section		200	
Total		56,840	a 27,210,000

a Pounds.

300 pounds fertilizer to each bale of cotton, 8,526 tons.

Two bales cotton produces 1 ton cotton seed .... 2)56,840 = total number of bales.

28,420 tons.

Less 10 per cent, planter's reserve 2,842

25,578 = total tons cotton seed.

EXHIBIT B.

COTTON STATISTICS FOR TERRITORY NORTH OF ALABAMA AND VICKSBURG RAILWAY.

Calling your attention to the railroad map * of Mississippi, would say that the country to be tapped by the proposed extension of the Gulf and Ship Island Railroad would constitute one-fourth of the State's total area.

Referring to report of Secretary Hester, of the New Orleans Cotton Exchange, of the cotton crop, by States, for 1897 and 1898, we find that Mississippi's production was 1,627,000 bales. Credit the proposed section with one-sixth of the total crop, you will find that the above-mentioned section produces 271,000 bales, less amount south of the Alabama and Vicksburg—56,840 bales—as shown by gin statistics herewith attached in Exhibit A. This would credit section north of the Alabama and Vicksburg with 214,000 bales. Three hundred pounds of fertilizer to the bale would give us a total of 32,100 tons of fertilizer above the Alabama and Vicksburg and up to the Tennessee State line, plus 8,526 tons south of the Alabama and Vicksburg; total, 40,626 tons. Estimated cost of hauling, at $6 per ton, $243,756. We refer you to letters hereto attached to sustain this estimate.

Estimated losses to planters on cotton seed, calculating 2 bales of cotton to make 1 ton of seed, with production of 214,000 bales of cotton, 107,000 tons of seed.

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* Not printed.

LETTER OF MESSRS. D. C. M'RANEY & CO.

MOUNT CARMEL, MISS., *December 8, 1898.*

DEAR SIR: In reply to yours of 5th instant, we beg to say that our usual rate on wagon freights from our town is 50 cents per hundredweight each way.

Yours, truly,

D. C. MCRANEY & CO.

Maj. J. W. PHILLIPS, *Hattiesburg, Miss.*

LETTER OF MESSRS. BYRD & THOMPSON.

MISH, MISS., *December 8, 1898.*

DEAR SIR: In reply to your query in regard to freights on fertilizer, etc., from railroad point to Mish, our place of business, we would say that the average cost is 40 cents per hundred.

Yours, truly,

BYRD & THOMPSON.

Mr. J. M. PHILLIPS, *Hattiesburg, Miss.*

EXHIBIT C.

Timber estimates by counties.

County.	Township.	County.	Township.
Harrison	16	Simpson	15
Perry	30	W. Jasper	10
Marion	22	E. and S. Rankin	14
Lawrence	10	Scott	16
Covington	16	Newton	8
W. Jones	8		
Smith	19	Total	184

Number of sections in a township, 36; total number of sections, 6,624; 640 acres to the section; total number of acres, 4,239,360; estimated cut of timber per acre, 4,000 feet; total number of feet, 16,957,440,000.

This comprises section south of the Alabama and Vicksburg, including part of Newton and Scott counties north. Appended hereto please find estimates of cuts from prominent lumber men to sustain our figures.

LETTER OF THE COLUMBIA, LUMBERTON AND GULF RAILWAY COMPANY.

COLUMBIA, LUMBERTON AND GULF RAILWAY COMPANY,
OFFICE OF GENERAL MANAGER,
Lumberton, Miss., December 9, 1898.

MY DEAR SIR: Our experience in the sawmill business convinces us beyond any question of doubt that the first two counties north of Hattiesburg will yield an average all the way through of 8,000 feet of merchantable such as we are now cutting. The land in the vicinity of the Alabama and Vicksburg might fall down to 6,000 feet, but am not positive as to this. There are considerable hard woods and also some bodies of pine north of the Alabama and Vicksburg, but am not in shape to give you information about that. I am in such a stew with the Government contract that I have not had the time to devote to this that I would have liked to. I have just talked this matter over with Mr. White, who has been in the business ever since 1858, and he agrees with me on these estimates.

Yours, truly,

J. H. HINTON, *General Manager.*

Mr. J. M. PHILLIPS, *Gulfport, Miss.*

LETTER OF THE ESTABUTCHIE LUMBER COMPANY.

ESTABUTCHIE LUMBER COMPANY,
Estabutchie, Miss., December 5, 1898.

DEAR SIR: Your favor of 4th, written from Jackson, Miss., to hand. As near as we can say, we estimate that about 6,000 feet per acre will be an average, including hard woods.

Trusting this will be what you want, we are,

Very truly, yours,

ESTABUTCHIE LUMBER COMPANY.

J. M. PHILLIPS, Esq., *Hattiesburg, Miss.*

LETTER OF MESSRS. EASTMAN, GARDINER & CO.

LAUREL, MISS., *December 6, 1898.*

DEAR SIR: Replying to your letter of December 5, would say that we think it safe to estimate pine and hard-wood timber at an average of 6,000 feet per acre, taking the territory north and west of Hattiesburg and south of the Alabama and Vicksburg Railway.

Very truly, yours,

EASTMAN, GARDINER & CO.

Mr. J. M. PHILLIPS, *Hattiesburg, Miss.*

LETTER OF THE J. J. NEWMAN LUMBER COMPANY.

HATTIESBURG, MISS., *December 7, 1898.*

DEAR SIR: In reply to your query of even date, beg to advise that we find from experience that the yield of yellow pine and hard wood from the lands lying adjacent to the town of Hattiesburg is about 6,500 feet per acre.

Trusting that this is the information you desire, we remain,

Yours, very truly,

J. J. NEWMAN LUMBER COMPANY,
Per J. J. NEWMAN, *President.*

Maj. J. M. PHILLIPS, *City.*

LETTER OF MESSRS. PARKER & WILDER.

McLAURIN, MISS., *December 10, 1898.*

DEAR SIR: Replying to your inquiry of recent date, will say our timber for the last twelve months has averaged 6,112 M. feet logs per acre.

Yours, truly,

PARKER & WILDER.

Mr. J. M. PHILLIPS, *Hattiesburg, Miss.*

EXHIBIT D.

NAVAL STORES.

Number of sections of land as shown in territory by Exhibit C, 6,624; estimated pounds of naval stores to each section, 320,000 pounds; total, 2,119,680,000 pounds.

We call your attention to letters hereto attached to sustain our estimates on naval stores.

LETTER OF MESSRS. HAWKINS & COMPANY.

HATTIESBURG, MISS., *December 9, 1898.*

DEAR SIR: The gross tonnage of naval stores produced on 160 acres of land is about 85,000 pounds.

Yours, truly,

HAWKINS & CO.,
Scanlan.

Maj. J. M. PHILLIPS.

LETTER OF MR. J. S. TURNER.

HATTIESBURG, MISS., *December 9, 1898.*

The gross tonnage of naval stores produced from an average 160 acres of pine timber will be about 80,000 pounds.

Yours, truly,

J. S. TURNER.

Maj. J. M. PHILLIPS.

LETTER OF MR. C. J. GRAY.

HATTIESBURG, MISS., *December 9, 1898.*

DEAR SIR: Judging from reports received in three years' practical experience in the turpentine manufacturing business, will state the average yield per annum of crude turpentine per 160 acres is about 80,000 to 85,000 pounds.

C. J. GRAY.

Maj. J. M. PHILLIPS, *City.*

STATEMENT OF VALUATIONS AS SHOWN BY THE ASSESSMENT ROLLS OF REALTY, 1896.

AUDITOR'S OFFICE, *Jackson, Miss.*

Counties.	Subdivisions.	Valuations.
Attala	Tps. 13, 14, 15, and 16, Rs. 8 and 9 E	$280,021.00
Benton	Entire	444,898.00
Calhoun	do	561,631.00
Chickasaw	Tps. 12, 13, 14, and 15, Rs. 1, 2, 3, and 4 E	841,583.00
Choctaw	Entire	524,211.00
Clay	Tps. 15, 16, and 17, Rs. 3 and 4 E., and Tps. 20 and 21, Frl., Rs. 12 and 13 W.	265,455.00
Covington	Entire	454,236.00
Harrison	do	2,661,120.00
Jasper	Tps. 10, Rs. 11, 12, and 13 W., and Tps. 1, 2, 3, and 4, Rs. 10, 11, and 12 E.	475,572.00
Jones	Tps. 6, 7, 8, 9, and Frl. 10, Rs. 13 and 14	293,337.50
Lawrence	Tps. 5, 6, 7, 8, and Frl. 9, Rs. 18, 19, and Frl. 21 W	536,090.00
Leake	Entire	696,267.00
Marion	do	1,165,105.00
Neshoba	do	478,883.00
Newton	Entire (except Tps. 5, 6, 7, and 8, R. 13, these being the extreme eastern tier of townships).	948,592.10
Oktibbeha	Tps. 17, 18, 19, and 20, Rs. 12 and 13 E	273,626.00
Perry	Entire	1,391,448.00
Pontotoc	do	740,438.00
Rankin	Tps. 3, 4, 5, 6, 7 and 8, Rs. 4 and 5 E	506,947.00
Scott	Entire	777,077.00
Simpson	Tps. 9 and 10, Rs. 17, 18, 19, and 20 W., and Tps. 1 and 2, Rs. 3, 4, 5, and 6 E.	395,195.00
Smith	Entire	496,577.00
Tippah	do	587,979.00
Union	do	945,294.00
Webster	do	582,344.00
Winston	Entire (except Tps. 13, 14, 15, and 16, R. 14 E., same being the extreme eastern tier of townships).	506,652.00
	Grand total	17,830,578.60

I, W. D. Holder, auditor of public accounts, do certify that the above and foregoing statement of valuations is true and correct, as shown by the "assessment rolls, 1896," of the counties named, said rolls being now on file in this office.

Given under my hand and official seal, this the 7th day of December, 1898.

[SEAL.]

W. D. HOLDER,
Auditor Public Accounts.

RESOLUTIONS OF THE MAYOR AND BOARD OF ALDERMEN OF GULFPORT.

GULFPORT, MISS., *December 6, 1898.*

Be it resolved by the mayor and board of aldermen of the town of Gulfport, Miss., That we respectfully submit to Maj. Wm. T. Rossell the following facts:

That Gulfport is the southern terminus of the Gulf and Ship Island Railroad, which is now in operation from here to Hattiesburg, a distance of 70 miles, and soon to extend through the State, and which has a branch projected to Columbia; railroad now built 18 miles, known as the Columbia, Lumberton and Gulf Railroad.

That from information before us there are now sawmills in operation along these roads with a daily capacity of 700,000 feet of pine lumber; that the natural market for said lumber is in Cuba and other West India Islands, South America, and Europe, via Gulfport and Ship Island Harbor.

That owing to the want of deep water at the pier at Gulfport this lumber must be transferred on barges from the pier to the ships at the great expense of $1 per thousand feet, and can only be shipped on vessels coming into port light, as they can not land to discharge their cargoes, and therefore charge lighter freights.

That a channel to the pier at Gulfport sufficient to allow the ships to discharge and receive their full cargoes at the pier would save the lumbermen $1 per thousand feet in loading, and ships being able to bring discharge loads could be chartered at about $1 per thousand feet less than now; that the risk in transferring lumber and timber amounts to at least 25 cents per thousand; and then the shipowners hesitate to send their vessels here light, when they would be glad to come by hundreds loaded and discharge their cargoes. Under the existing circumstances it is impossible to insure the timber and lumber, when if we had a proper channel and breakwater there would be no risk on insurance, saving the lumbermen $2.25 per 1,000 feet, or $1,500 per day on their present cutting capacity, or about $500,000 per annum.

That the Gulf and Ship Island, and Columbia, Lumberton and Gulf railroads are now operated through a section of pine forest. An area of 15 miles on each side of the track of said lines will yield over 5,000,000,000 feet of pine lumber, which should pass through Gulfport and Ship Island Pass, and this channel would save the lumbermen $2.25 per thousand, or $11,250,000 on the present stand of timber.

That a channel to Gulfport would insure the completion of the Gulf and Ship Island Railroad through the State, and the extension of the Columbia, Lumberton and Gulf Railroad to Natchez.

That these extensions would increase the quantity of timber and lumber to be handled not accessible to other roads more than three times its present amount, or to over 15,000,000,000 feet, and save the lumbermen over $33,750,000 on pine lumber and timber. The area tributary to this road is more than double that referred to above.

That this channel would open a port for the shipment of cotton, which would save to the people of Mississippi $1 per bale on at least 500,000 bales of cotton per annum in freights, besides $2 per bale, the present cost of hauling it in wagon to railroad, making a total of $1,500,000 per annum, and an equal amount saved to the people on their freights on articles of consumption, making a total saving of $3,000,000 per annum saved to the Mississippi farmers. The records of Harrison County show the facts to be that the year prior to the beginning of work on the Gulf and Ship Island Railroad the assessment of said county, exclusive of railroads, 1896, was:

Real property	$924,608
Personal property	287,419
Total	1,212,027

For 1898 the assessment is:

Real property	$2,600,000
Personal property	659,020
Total	3,259,020

Showing an increase, exclusive of railroad proper, of $2,046,993, nearly three times the original assessment. Should this road be extended through the State and increase the assessment in all other counties at the same ratio, it would increase the assessment of the State about $35,000,000.

That the great amount of commerce to be opened up can not be foreseen even by the most prolific mind. But it sufficeth to say beyond any controversy on expenditures on the part of the Government, which we are advised need not cost exceeding $1,000,000, would save to the people of Mississippi from $3,000,000 to $4,000,000 per annum on business now being worked at great disadvantage, and would increase the present business several times.

Passed this the 12th day of December, 1898.

T. P. GARY, *Clerk.*

Be it ordered, That A. McAlpin be appointed as a committee of one to draft resolutions to be presented to Maj. W. T. Rossell in regard to deep water at this place.

Be it ordered, That the resolutions prepared by the committee appointed for that purpose, addressed to Maj. W. T. Rossell, be and are hereby adopted and ordered filed, and three copies thereof, together with the orders on the minutes, be forwarded by the clerk to Maj. W. T. Rossell.

I hereby certify that the foregoing resolutions and orders are true copies of the records of this place.

[SEAL.]

T. P. GARY,
Clerk of the Town of Gulfport, Miss.

MINUTES OF THE PROCEEDINGS OF THE DEEP-WATER CONVENTION OF MISSISSIPPI, NOVEMBER 25, A. D. 1898.

Pursuant to the call issued by the citizens of Hattiesburg, the representatives from the State of Mississippi met in convention assembled at the court-house, in the city of Hattiesburg, Miss., on Friday, the 25th day of November, A. D. 1898, and at 11.20 a. m. were called to order by Mayor W. M. Connor, who nominated Hon. J. P. Carter as chairman, with H. H. Folk and F. G. Wisner as secretaries, who on motion were elected by acclamation.

Chairman Carter announced the object of the meeting to be the bringing together of the representative business men of the State of Mississippi, to take such action as their judgment would dictate to further the interests of deep water at Ship Island Harbor, by dredging the proper channel from said harbor to such point as should be determined upon by the result of the survey now being made by the National Government under the immediate direction of Maj. W. T. Rossell, United States engineer.

On motion the following committee on resolutions was appointed: Hon. E. J. Bowers, chairman; J. M. Phillips, W. A. White, James S. Eaton, George S. Gardiner, J. S. Hamilton, and C. C Swetman.

After some discussion as to the best mode of procedure it was resolved to invite the following speakers to address the meeting: Col. J. S. Hamilton, Hon. E. J. Bowers, Governor A. J. McLaurin, Hon. J. S. Eaton, Hon. W. A. White, Hon. T. J. Hardy.

Hon. E. J. Bowers moved that as the noon hour had arrived this meeting take a recess until 3 o'clock p. m. for dinner, and to give the committee on resolutions time to properly prepare their report, which was carried, and the convention adjourned until 3 p. m.

At 3 o'clock the convention was promptly called to order by Chairman Carter, when the Hon. E. J. Bowers, chairman of committee on resolutions, submitted the following report to the convention:

MR. CHAIRMAN: Your committee on resolutions beg leave to report as follows:

All that portion of the State of Mississippi lying west of the Mobile and Ohio Railroad and east of the Illinois Central is at present without railroad facilities, the farmers of said section being forced to haul their products from 20 to 50 miles, entailing upon them untold inconvenience and expense.

This is at present an undeveloped zone, comprising approximately 20,000 square miles below the Alabama and Vicksburg Railway and about twice that area above that line. This zone can not and will not be developed except by the construction of a railroad or highway of commerce through its territory, and while their products at present go out through New Orleans and Mobile these outlets are, as to this section, unnecessarily expensive and burdensome, besides being tedious and difficult of access.

While the Gulf and Ship Island Railroad penetrates this section about 70 miles, no railroad can or will be built through the whole belt unless it can reach some point on the Gulf at which deep water is assured.

The territory within the lines fixed above furnishes every product to be found in the State of Mississippi. Great fields of cotton and other agricultural outputs, as well as immense forests of virgin pine and hard wood, would be reached and opened by such a road, resulting not only in the great betterment of existing enterprises, but also in the opening and developing of the great resources of that section, now dormant because of the want of a deep-water outlet.

In addition to the immense tonnage to be thus taken out of this section, the incoming freight would be almost equal in amount. Fertilizer, agricultural supplies, merchandise of every description, and machinery to supply the needs of the producers would all go over that line, the cost being thereby greatly lessened, to say nothing of the saving in time and the increase in the facilities for doing business.

These large exports and imports going over such a line, wholly within the borders of the State, could but result in the building of a large and flourishing seaport on our coast capable of handling and directing this great trade.

If there was no place on our shores at which a harbor could be dredged and deep water thus procured, this condition of affairs might be borne, but when we consider that Ship Island is one of the finest natural harbors in the world, and that by a reasonable expenditure of money a deep-water channel can be dredged from Ship Island to the main shore, it becomes unendurable.

We do not believe that when these matters are properly represented to the Government officials we will be forced to wait long for its aid. We hail the present survey now being made of the waters of Ship Island and the Gulf as a harbinger of better things, and in order that this much desired result may be reached—

Be it resolved, That the Government of the United States is respectfully and earnestly memorialized and requested to make a suitable and reasonable appropriation and provision to dredge a deep-water channel from Ship Island to the main shore, and to build on said shore a safe and secure harbor sufficient for the needs of the commerce and interests above recited.

Be it further resolved, That our Senators and Representatives in Congress be earnestly requested to give this matter their immediate attention and cordial support.

Respectfully submitted.

J. M. PHILLIPS,
E. J. BOWERS,
J. S. HAMILTON,
J. S. EATON,
W. A. WHITE,
G. S. GARDINER,
C. C. SWETMAN,
Committee.

On motion, the report of the committee was adopted unanimously. It was then moved and carried that the following-named gentlemen be appointed a committee on statistics, whose duty it should be to gather and prepare statistics to be furnished Maj. W. T. Rossell, the United States engineer in charge of the surveys being made at Ship Island Harbor: J. S. Hamilton, J. M. Phillips, W. H. Hardy, W. N. Nash, J. W. T. Falkener, George S. Gardiner, and J. H. Hinton.

Hon. J. S. Hamilton submitted the following, which was unanimously adopted:

"*Resolved*, That a deep-water channel from Ship Island Harbor to the shore will insure the completion of the Gulf and Ship Island Railroad through the central part of the State; that this road would run through a portion of the State now destitute of either railroad or water transportation, embracing about one-third the area of the State of Mississippi, and with a population of about 400,000, who depend entirely upon agriculture for a support; this road would transport about 250,000 bales of cotton now being raised and hauled on wagons a long distance at great expense, where it is put on railroads and shipped at heavy freight charges to ports in other States, and that said road would furnish an annual saving of $2 per bale on 250,000 bales of cotton, or $500,000 per annum on the present production of cotton alone; that said road would save the cotton planters at least an equal amount on their freights and fertilizers now hauled on wagons from distant points to their homes, making a total saving of $1,000,000 per annum to the farmers in this portion of the State now dependent on the proceeds of 4-cent cotton for a support; that the present population in this section pay annually a revenue of about $1,600,000 to the United States Government, and have never yet been the direct or indirect object of any national appropriation for improvements; that the development of this channel from Ship Island to the mainland would be the immediate means of extending said road, and would bring into market about 18,000 square miles of land south of the Alabama and Vicksburg Railway, and double that amount north of said road, the greater part of which is well timbered with pine and hardwood and can not be utilized by any other means of transportation; that the soil and climate in this section of country is well adapted also to the culture of fruits and vegetables, but for the want of this transportation the people can not dispose of them, and are thereby reduced to the production of the one commodity, to wit, 4-cent cotton.

"As a proof of these figures we can refer to business done on the Gulf and Ship Island Railroad from Hattiesburg to the Gulf during the last fiscal year. From June 30, 1898, there was moved over this line 198,680 tons of freight, consisting of lumber, timber, naval stores, cotton, merchandise, etc., where two years previous the commerce was practically nothing."

Hon. A. M. Dahlgreen then introduced the following, which was adopted by a rising vote:

"*Resolved*, That this deep-water convention urge upon the people of South Mississippi that they pledge themselves to support no candidate for office, either city, county, district, or State, who does not pledge himself to use his personal and political influence to obtain deep water for Mississippi and everything conducive thereto."

The chair then introduced Hon. J. S. Hamilton, who said that he was a deep-water advocate and an expansionist, not for the Philippine Islands, but for the expansion of the Gulf and Ship Island Railroad. He reviewed his connection in the past with this great enterprise.

Hon. A. M. Dahlgreen, being called on, made an address in favor of Ship Island Harbor.

Hon. E. J. Bowers spoke on the necessity of more railroad facilities in the interior of the State, to give the people opportunity to transport their products. The lands are well timbered, and, after clearing, the land, the same being extremely fertile, will produce a large amount of products to enrich the State at large; that this can not be done without railroads to transport and a harbor for the ships to carry the cargoes to the markets of the world.

The chairman then introduced Governor A. J. McLaurin. The governor made a business address to the convention. The subject of deep water was not one for the coast counties alone, but for the whole State and sister States which will be benefited by a deep-water harbor connection by a railroad throughout the State.

The governor is optimistic on the success of the harbor, and he feels sure that it will be built during the present generation. It can not fail. The people must not ask an appropriation as charity, but demand an appropriation, as it is not right or just to tax the people of this State to build and maintain harbors at New York and on the Atlantic seaboard and not give assistance to this harbor for Mississippi. This harbor will not only aid the extension of the Gulf and Ship Island Railroad, but will be the means of having other roads built.

The necessity for the harbor is not a question for discussion; it is a necessity for the State. All local preferences must be set aside, and let the United States engineers, after a scientific investigation and survey, decide the best place, and locate the place where the deep-water channel shall reach the coast. The Government spends millions over 7,000 miles from here; it should spend money for needed improvement near home.

The governor emphasized the necessity of the people taking action in their own behalf.

The following resolutions were then submitted in the order named, and, on motion, were adopted:

By R. S. E. Travis:

"Whereas Hon. W. H. Hardy, of Meridian, Miss., has been for a number of years identified with the construction and development of the Gulf and Ship Island Railroad and a deep-water harbor at its terminus at Gulfport, and untiring in his efforts to promote said enterprises and the development of this section of our State; and

"Whereas his labors along the line indicated have been of inestimable worth to this section of the State; therefore, be it resolved by the people in the Deep Water Harbor Convention assembled,

"First. That we very much regret that circumstances are such that he could not attend this meeting to-day:

"Second. That recognizing his worth in the past and his power and ability to accomplish much for us in the future, we hereby pledge our hearty cooperation in his continued efforts along the line indicated."

By Mr. T. M. Evans.

"*Resolved*, That it is the sense of this convention assembled that our representative in Congress, the Hon. J. H. McLain, use every exertion in his power to obtain from Congress an appropriation at the coming session, for the improvement of Ship Island Harbor."

The chairman then introduced the Hon. J. S. Eaton, who addressed the convention in an able and forcible manner. Speaking from personal experience, he recited the inconveniences and hardships attending the marketing of the products of his section of the State, notably the hauling of cotton some 60 miles by ox teams.

Hon. T. J. Hardy being introduced, ably seconded his predecessor, and also called attention to the wonderful increase in values of realty along the line of the New Orleans and Northeastern Railway, following so rapidly and so surely its through connections from a deep-water harbor in a sister State to the trunk railway lines to other States.

After some pertinent remarks made by many of those present, on motion the convention adjourned subject to the call of the chairman.

J. P. CARTER, *Chairman.*

Attest:
H. H. DOLKE, *Secretary.*

LETTER OF THE GULF AND SHIP ISLAND RAILROAD COMPANY.

GULF AND SHIP ISLAND RAILROAD COMPANY,
OFFICE OF THE GENERAL MANAGER,
Gulfport, Miss., December 17, 1898.

DEAR SIR: I beg to hand you, under separate cover, certified copies of resolutions passed by the boards of supervisors in 21 counties of the State of Mississippi memorializing Congress to dredge a deep-water harbor to our coast, and naming Gulfport as their choice of places.

These were sent me because of a letter I addressed to certain clerks of these boards, requesting them if interested to so signify it.

I believe that you have now abundant evidence of the desire of the people throughout a great portion of the State that this work be done, and the great necessity for it in order that this section of the United States be developed; and further, that there is abundant commerce seeking this outlet to justify the work. As an evidence of our good faith, I would say that our company are now erecting in our steamer *Cape Charles* dredging machinery of very large capacity, and propose to at once commence the work of filling our pier, making extensive docks and wharves, thereby making an anchorage basin safe for vessels at all times, and we will agree to join the General Government in doing all the work necessary to make a safe harbor here with a channel to it of 21 feet. In other words, we will move one-half of the material to be excavated and put in one-half of the material necessary at our expense.

Expecting a favorable report from you, I remain,

Yours, very truly,

S. S. BULLIS, *General Manager.*

W. T. ROSSELL, *Major of Engineers, U. S. A.*

CERTIFIED COPIES OF RESOLUTIONS OF SUPERVISORS OF VARIOUS COUNTIES IN THE STATE OF MISSISSIPPI AND OF MAYOR AND CITY COUNCIL OF COLUMBUS, MISS.

ADAMS COUNTY.

Board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Adams County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county an order was then and there made by said board, which was in the following words, to wit:

The question of the Natchez and Gulfport Railroad having come up for discussion, the following resolutions were adopted:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State; and

Whereas the people of Mississippi, and especially Adams County, are deeply interested in the early building of the Natchez and Gulfport Railroad, recently projected to be built from Natchez to Gulfport, Miss., and

Whereas in order to secure the early extension and building of both said roads, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Adams, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi and Adams County, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

I, John F. Jenkins, clerk of the chancery court and ex officio clerk of the board of supervisors, in and for the county and State aforesaid, do hereby certify that the above and foregoing is a just, true, and perfect copy of an order of the said board of supervisors made and entered at their December term thereof, A. D. 1898, as the same appears of record in my said office, in minute book E, page 229.

Given under my hand and seal of office, at Natchez, this the 10th day of December, A. D. 1898.

[SEAL.] JOHN F. JENKINS, *Clerk.*

CITY OF COLUMBUS.

STATE OF MISSISSIPPI, *Lowndes County, City of Columbus:*

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said railroad:

Now, therefore, be it resolved by the mayor and city council of the city of Columbus, Miss., That it is the sense of the people of said city that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that

Gulfport, the terminus of said road, and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money, looking to the dredging of a channel from Ship Island to the main shore and the consequent making of a harbor.

The above is a true and perfect copy of the proceedings of the mayor and city council.

W. D. HUMPHRIES, *Mayor City of Columbus.*

COLUMBUS, MISS., *December 6, 1898.*

NEWTON COUNTY.

Whereas the county of Newton, State of Mississippi, has a fertile soil capable of supporting a large population, but is largely undeveloped and sparsely settled because of lack of railroad and transportation facilities, the products of the soil being marketed only at great expense, and the virgin forest with which a large part of its surface is covered is to a considerable extent valueless for the same reason; and

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the county of Newton, through or near which the projected line of said road will run, it being the only hope for the development of the county; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the County of Newton, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from Ship Island to the main shore, and the consequent making of a harbor.

STATE OF MISSISSIPPI, *Newton County:*

I, Eugene Carleton, chancery clerk and ex officio clerk of the board of supervisors, do hereby certify that the foregoing is a correct copy of an order entered upon the minutes of said board in book 3, page 359.

Given under my hand and seal of office this the 14th day of December, 1898.

[SEAL.] EUGENE CARLETON, *Clerk.*

COVINGTON COUNTY.

Board of supervisors, December term, A. D. 1898.

STATE OF MISSISSIPPI, *Covington County.*

Be it remembered that on Monday, the 5th day of December, A. D. 1898, the same being one of the days of the aforesaid meeting of the board of supervisors, the following, among other proceedings, was had and entered of record on the records of the said board, in the words and figures following, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of industrial importance to the State, and more especially to the County of Covington, through or near where the Gulf and Ship Island Railroad will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of a harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the County of Covington, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a harbor.

STATE OF MISSISSIPPI, } *ss:*
Covington County. }

I, Jas. D. Buchanan, clerk of the chancery court and ex officio clerk of the board of supervisors of said county, do hereby certify that the above and foregoing is a true copy of an order of said board, made and entered of record on the day and year first above written, as the same appears of record in my office in minute book 3, page 428.

Given under my hand and the seal of said board of supervisors at my office this 9th day of December, 1898.

[SEAL.] JAS. D. BUCHANAN, *Clerk.*
[Revenue stamp.]

WARREN COUNTY.

STATE OF MISSISSIPPI, *Warren County.*

At a term of the board of supervisors of said county, held at the court-house thereof, in the city of Vicksburg, on the 6th day of December, 1898:

Present: Hon. H. F. Simrall, president; William Curphey, E. C. Scott, J. S. Crouch, W. B. Black; J. D. Laughlin, clerk; D. N. Hebron, sheriff.

Among other proceedings in said board of supervisors on the day and year aforesaid was the following, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run, and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Warren, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road, and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a harbor; that access to said harbor either from the north or south is through a channel of ample depth to accommodate vessels of deepest draft, and that the harbor itself is safely protected from the storms and waves of the outer Gulf.

I, J. D. Laughlin, clerk of said board of supervisors of Warren County, in the State of Mississippi, do hereby certify that the within and foregoing is a true transcript from the records of said board.

In testimony whereof, I have hereunto set my hand and affixed the seal of said board at office this the 10th day of December, 1898.

[SEAL.] J. D. LAUGHLIN, *Clerk.*

SMITH COUNTY.

Whereas the county of Smith, State of Mississippi, is remote from any railroad line, and is largely covered by virgin forest of pine and hard wood, which when removed from the land leaves it susceptible of a high state of cultivation, yielding abundant crops of cotton, corn, oats, pease, rice, sugar cane, potatoes, and other produce adapted to the soil and climate; it also has inexhaustible quarries of fireproof rock, which has been thoroughly tested by the citizens for chimneys and cane-mill furnaces, all of which in order to reach a market or line of transportation must be hauled on wagons a distance of 20 to 40 miles over bad roads, at great expense of keeping up extra teams for that purpose, and the only hope of bettering this condition is the building of the Gulf and Ship Island Railroad, which will develop the county and furnish a very much-needed communication with the outside world; and

Whereas in order to secure the extension of said road it is highly important that the Government of the United States should turn its attention to the development of Ship Island Harbor and at Gulfport, at the terminus of said railroad:

Now, therefore, be it resolved by the board of supervisors of the county of Smith, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a valuable harbor to the General Government, and especially to the people of the State of Mississippi.

A. M. ANDERSON, *President of the Board.*
H. A. THOMPSON, *Member of the Board.*
W. J. EATON, *Member of the Board.*
A. C. HALES, *Member of the Board.*
J. Z. BARBER, *Member of the Board.*

STATE OF MISSISSIPPI, *Smith County:*

I, W. H. Jones, clerk of the chancery court of said county, hereby certify that the above and foregoing is a true and correct copy of a resolution passed by the board of supervisors of said county at the December term, 1898, thereof, as appears on the minutes of said board, Book A, pages 475 and 476, in my office.

Witness my hand and seal of office, dated at Raleigh, Mississippi, this the 10th day of December, 1898.

[SEAL.] W. H. JONES, *Clerk.*

LOWNDES COUNTY.

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Lowndes, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi; and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is a proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

F. B. FRANKLIN,
President Board Supervisors, Lowndes County, Miss.

HANCOCK COUNTY.

By the board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Hancock County:*

Be it remembered that at the above stated term of the board of supervisors of said county the following resolution was, by order of said board, spread upon the minutes, to wit:

On motion, duly seconded and carried, it is ordered that the following resolution be spread upon the minutes of this board, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of a harbor at Ship Island at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Hancock, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from Ship Island to the main shore, and the consequent making of a harbor.

Be it further resolved, That a copy of these resolutions be transmitted by the clerk of this board to each of our Senators in the Senate of the United States, and also a copy to F. A. McLain, Member of Congress from this district.

I, Emile H. Hoffmann, clerk of the chancery court and ex officio clerk of the board of supervisors in and for the county and State aforesaid, do hereby certify that the above and foregoing transcript is a true and correct copy from the minutes of said board, and entered thereon at the December term, 1898, on the 5th day of said month, as the same appears from said minutes, in Book D, on page 472.

Given under my hand and official seal at Bay St. Louis this the 7th day of December, A. D. 1898.

[SEAL.] E. H. HOFFMANN, *Clerk.*

MONROE COUNTY.

STATE OF MISSISSIPPI, *Monroe County:*

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Govern-

ment of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Monroe, That it is the sense of the people of said county that the improvement of said harbor at Gulfport, or some point opposite Ship Island or adjacent thereto, is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

The foregoing is a true and perfect copy of a resolution passed by the board of supervisors of Monroe County, Miss., at their December, 1898, meeting, as appears in minute book No. 6, page 274.

Given under my hand and seal this December 8, 1898.

[SEAL.] T. O. JONES,
Chancery Clerk of Monroe County, Miss.

WAYNE COUNTY.

Supervisors' court, December term, A. D. 1898.

STATE OF MISSISSIPPI, *Wayne County:*

Whereas we deem it of great importance to the people of the State of Mississippi that the harbor of Ship Island be improved:

Now, therefore, be it resolved by the board of supervisors of said county, That it is the sense of the people of the said county of Wayne that the improvement of the harbor of Ship Island is of the utmost importance to said State.

STATE OF MISSISSIPPI, *Wayne County:*

I, W. S. Davis, clerk of the supervisors' court of said county, do certify that the above is a true copy of the order made by the board at the December term, 1898, as shown from the minutes.

Given under my hand and seal December 6, 1898.

[SEAL.] W S. DAVIS, *Clerk.*

MADISON COUNTY.

STATE OF MISSISSIPPI, *Madison County:*

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Madison, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

Ordered.

W. M. REID,
President Board of Supervisors.

Entered on the minutes of the board of supervisors of Madison County. Min. B. I, p. 381.

G. R. KEMP, *Clerk.*

TATE COUNTY.

Supervisors' court, December term, 1898.

THE STATE OF MISSISSIPPI, *Tate County:*

Be it remembered that at the above-stated term of the honorable supervisors' court of said county an order was then and there made by said court, which was in the following words, to wit:

No. 178.—In the matter of establishing a deep-water harbor on the coast of Mississippi and memorializing Congress for an appropriation to insure deep water from Gulfport to Ship Island.

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State and more especially to the counties through or near which the projected line of said road will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Tate, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a harbor.

I, Sam. J. House, clerk of the supervisors' court in and for said county and State aforesaid, do hereby certify that the above and foregoing allowance is a just, true, and perfect copy of an order of the said court made and entered at its December term thereof, A. D. 1898, as the same appears of record in my said office, in minute book D, page 533.

Given under my hand and official seal of said court, at my office, this 8th day of December, A. D. 1898.

[SEAL.] SAM. J. HOUSE, *Clerk.*
[Revenue stamps.]

PEARL RIVER COUNTY.

Board of supervisors, December term, A. D. 1898.

STATE OF MISSISSIPPI,
County of Pearl River. } *ss:*

Be it remembered that on Monday, the 5th day of December, A. D. 1898, the same being one of the days of the aforesaid meeting of said board of supervisors, the following among other proceedings was had and entered of record on the records of said board, in the words and figures following, to wit:

Whereas the extension of the Columbia, Lumberton and Gulf Railroad, operating in connection with the Gulf and Ship Island Railroad, is a matter of great importance to the State, and especially to the county of Pearl River; and

Whereas, in order to secure the extension of said road, it is of vital importance that the Government of the United States give its attention to the development of the harbor at Ship Island and at Gulfport and at the terminus of the Gulf and Ship Island Railroad:

Be it resolved by the board of supervisors of the county of Pearl River, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport is the proper place for the expenditure of money looking to the dredging of a channel from Ship Island to the main shore, and the consequent making of a harbor.

Resolved further, That the clerk of this board furnish a certified copy of these resolutions to our Representative in Congress from the Sixth Congressional district of Mississippi.

THE STATE OF MISSISSIPPI,
County of Pearl River. } *ss:*

I, N. Batsen, clerk of the chancery court and ex officio clerk of the board of supervisors of said county, do hereby certify that the above and foregoing is a true copy of an order of said board, made and entered of record on the day and year first above written, as the same appears of record in my office in minute book 2, page 225.

Given under my hand and the seal of said board of supervisors at my office this 6th day of December, 1898.

[SEAL.] N. BATSEN, *Clerk.*

SCOTT COUNTY.

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, more especially the county of Scott, through which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Govern-

ment of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, the terminus of said road; and

Whereas the State of Mississippi has no seaport town for the outlet of her immense timber and agricultural products, and the dredging of a channel from Ship Island to Gulfport and the extension of the Gulf and Ship Island Railroad will meet this great want:

Now, therefore, be it resolved by the board of supervisors of Scott County, That it is the sense of the people of said county that the improvement of the harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and which is immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a harbor.

STATE OF MISSISSIPPI, *Scott County:*

I, J. A. Ware, clerk of the board of supervisors of said county, hereby certify that the above is a true copy of the preamble and resolutions adopted by the board of supervisors of said county at the December term, 1898.

Witness my hand and seal of office, December 6, 1898.

[SEAL.] J. A. WARE, *Clerk.*

JONES COUNTY.

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State will open up to commerce the largest section of virgin timber lands now in the State; and

Whereas the said extension above referred to will run through as fine an agricultural section as there is in the State; and

Whereas the farmers along said proposed extension are put to the inconvenience of hauling their products 20 to 40 miles to market, the counties of Covington, West Jones, West Jasper, Smith, Simpson, Lawrence, and Marion alone producing, by actual gin statistics, 55,000 bales of cotton; and

Whereas in order to secure the said extension above mentioned it is vital that the Government of the United States should turn its attention to the development of a harbor on our Gulf coast, as recommended by our last legislature:

Now, therefore, be it resolved by the board of supervisors of the county of Jones, That insomuch as the interests of our people and the people of that portion of the State through which said Gulf and Ship Island Railroad is to run will be and is identified with the development of a harbor at Gulfport, the terminus of the G. and S. I. R. R., it is the sense of the people of said county that Gulfport, immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of the channel from said Ship Island to the main shore, and the consequent making of a harbor.

THE STATE OF MISSISSIPPI, *County of Jones:*

I, J. A. Trimon, clerk of the board of supervisors of said county and State, do hereby certify that the above is a true copy of the resolutions adopted by the board of supervisors of said county at their December term, 1898, as the same appears of record of the minutes of the board of supervisors in Book B, page 412.

Given under my hand and seal this December 5, 1898.

[Revenue stamps.] J. A. TRIMON, *Clerk.*

COPIAH COUNTY.

Board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Copiah County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county an order was there and then made by said board which was in the following words, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Govern-

ment of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Copiah, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

I, J. D. Dampeer, clerk of the chancery court and ex officio clerk of the board of supervisors in and for the county and State aforesaid, do hereby certify that the above and foregoing is a just, true, and perfect copy of an order of the said board of supervisors, made and entered at their December term thereof, A. D. 1898, as the same appears of record in my office in minute book H, page 118.

Given under my hand and official seal, at office this the 14th day of December, A. D. 1898.

[SEAL.] J. D. DAMPEER, *Clerk.*

SUNFLOWER COUNTY.

Board of Supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Sunflower County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county an order was there and then made by said board which was in the following words, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Sunflower, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

I, W. P. Graham, clerk of the chancery court and ex officio clerk of the board of supervisors in and for the county and State aforesaid, do hereby certify that the above and foregoing is a just, true, and perfect copy of an order of the said board of supervisors made and entered at their December term thereof, A. D. 1898, as the same appears of record in my said office in minute book 4, page 235.

Given under my hand and official seal, at —— this 10th day of December, A. D. 1898.

[SEAL.] W. P. GRAHAM, *Clerk.*

COAHOMA COUNTY.

Board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Coahoma County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county an order was then and there made by said board which was in the following words, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas in order to secure the extension of said road it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Coahoma, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

STATE OF MISSISSIPPI, *Coahoma County:*

I, M. J. Bouldin, the undersigned clerk of the chancery court, and ex officio clerk of the board of supervisors in and for the above-named county, do hereby certify that the above and foregoing is a true and correct copy of an order of the board of supervisors of said county passed and adopted on the 5th day of December, 1898, and as the same appears of record on the minutes of said board, at pages 285 and 286.

Given under my hand and seal of said court, at my office, in Clarksdale, Miss., this the 6th day of December, 1898.

[SEAL.] M. J. BOULDIN, *Clerk.*

TALLAHATCHIE COUNTY.

Board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Tallahatchie County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county, an order was then and there made by said board which was in the following words, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run, and

Whereas in order to secure the extension of said road it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and at Gulfport at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Tallahatchie, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

I, D. W. Patterson, clerk of the chancery court and ex officio clerk of the board of supervisors in and for said county and State aforesaid, do hereby certify that the above and foregoing writ is a just, true, and perfect copy of an order of the said board of supervisors, made and entered at their December term thereof, A. D. 1898, as the same appears of record in my office, in minute book 5, page 354.

Given under my hand and official seal of said board of supervisors at my office this the 6th day of December, 1898.

[SEAL.] D. W. PATTERSON, *Clerk.*

FRANKLIN COUNTY.

Board of supervisors, December term, 1898.

STATE OF MISSISSIPPI, *Franklin County:*

Be it remembered that at the above-stated term of the honorable board of supervisors of said county an order was then and there made by said board, which was in the following words, to wit:

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, and more especially to the counties through or near which the projected line of said road will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island, and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Franklin, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfpo the terminus of said road, and immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from Ship Island to the main shore and the consequent making of a harbor.

I, E. H. Wenburth, clerk of the chancery court and ex officio clerk of the board of supervisors in and for said county and State aforesaid, do hereby certify that the above and foregoing writ is a just, true, and perfect copy of an order of the said board of supervisors made and entered at their December term thereof, A. D. 1898, as the same appears of record at my office in minute book, page ——.

Given under my hand and official seal of said board of supervisors at my office this the 6th day of December, 1898.

E. H. WENBURTH, *Clerk.*

NESHOBA COUNTY.

Whereas the county of Neshoba, State of Mississippi, has a fertile soil capable of supporting a large population, but is only thinly settled, for the reason that there is no railroad or navigable stream within or near its borders, and although a large amount of cotton and agricultural products are grown upon the lands that are worked it is marketed at a very great expense, having to be hauled over bad roads from 25 to 45 miles to reach a transportation line, and the virgin forest with which a large part of its surface is covered is of no value for the reason stated; and

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest importance to the State and more especially to the county of Neshoba, through or near which the projected line of said road will run, it being the only hope for the development of the county; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island, and at Gulfport, at the terminus of said road:

Now, therefore, be it resolved by the board of supervisors of the county of Neshoba, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road and immediately opposite Ship Island harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore and the consequent making of a harbor.

STATE OF MISSISSIPPI, *Neshoba County:*

I, S. H. Stribling, clerk of the chancery court in and for said county, certify that the foregoing and attached is a true copy of resolutions passed by the board of supervisors of Neshoba County at the December, 1898, meeting thereof.

Given under my hand and seal of office, affixed at Philadelphia, Miss., this December 7, 1898.

[SEAL.] S. H. STRIBLING, *Chancery Clerk.*

LEAKE COUNTY.

Whereas the county of Leake, State of Mississippi, has a fertile soil, capable of supporting a large population, but is only sparsely settled, for the reason that there is no railroad or navigable stream within its borders or near them, and although a large amount of cotton, wool, and other agricultural products are produced on the lands that are worked, it is marketed only at great expense because of having to be hauled over bad roads from twenty to forty-five miles to reach a transportation line, and the virgin forest with which a large part of its surface is covered is valueless for the same reason; and

Whereas the extension of the Gulf and Ship Island Railroad to the northern boundary of the State of Mississippi is a matter of the greatest industrial importance to the State, more especially the county of Leake, through which the projected line of said road will run; and

Whereas, in order to secure the extension of said road, it is vital that the Government of the United States should turn its attention to the development of the harbor at Ship Island and Gulfport, the terminus of said road; and

Whereas the State of Mississippi has no seaport town for the outlet of her immense timber and agricultural products, and the dredging of a channel from Ship

Island to Gulfport, and the extension of the Gulf and Ship Island Railroad will meet this great want:

Now, therefore, be it resolved by the board of supervisors of Leake County, That it is the sense of the people of said county that the improvement of said harbor at Gulfport is of the utmost importance to the State of Mississippi, and that Gulfport, the terminus of said road, which is immediately opposite Ship Island Harbor, is the proper place for the expenditure of money looking to the dredging of a channel from said Ship Island to the main shore, and the consequent making of a harbor.

Be it further resolved, That these resolutions be published in the county papers and that the clerk of this board furnish copy thereof to said papers for that purpose, and that copies be sent to our Senators and immediate Representative in Congress by said clerk.

STATE OF MISSISSIPPI, *Leake County:*

I, J. L. McMillon, clerk of the board of supervisors, in and for said county and State of Mississippi, hereby certify that the above and foregoing is a true and correct copy of a resolution passed by the honorable board of supervisors of above-named county and State, in regular session on the 5th day of December, 1898, as will appear from the minutes of said board on page 256 of minute book No. 4.

Given under my hand and official seal this December 9, 1898.

[SEAL.]
[Revenue stamp.]

J. L. MCMILLON,
Chancery Clerk and Clerk of the Board of Supervisors, Leake County, Miss.

LETTER OF THE COLLECTOR OF CUSTOMS, SHIELDSBORO, MISS.

OFFICE OF THE COLLECTOR OF CUSTOMS,
Port of Shieldsboro, Miss., December 9, 1898.

SIR: As requested in your letter of the 4th instant, I inclose a statement showing the number and tonnage of vessels that loaded in Ship Island Harbor during the fiscal year ending June 30, 1898, and the value of their cargoes.

I am not familiar enough with the commerce of the Sound ports to state all the advantages that would accrue from a 26-foot channel through Ship Island bar, but would suggest that large vessels would not be delayed a week or ten days by low water, as often happens under present conditions, if there were such a channel, and there would be a material reduction of insurance rates, and incidentally freights, if all sizes of vessels could go to sea from the harbor loaded without risk of grounding, and thereby springing a leak which would endanger the safety of the vessel the rest of the voyage.

Respectfully, yours,

J. H. ESPY, *Special Deputy Collector.*

Maj. WM. T. ROSSELL,
United States Engineer, Mobile, Ala.

Transactions of Biloxi customs office for fiscal year ending June 30, 1898.

	Vessels.	Tons.
Entrances in foreign trade	90	90,863
Clearances in foreign trade	65	61,527
Total	155	152,390
Entrances in coastwise trade	14	12,054
Clearances in coastwise trade	11	10,630
Total	25	22,684

Value of exports to foreign countries, $527,144.

The above statement shows the business actually done through the Biloxi office, and does not include the vessels, probably about 30 per cent of the above, that enter and clear at Pascagoula office, though they take on their cargo in Ship Island Harbor.

J. H. ESPY, *Special Deputy Collector.*

LETTERS OF THE COLLECTOR OF CUSTOMS, BILOXI, MISS.

OFFICE OF THE COLLECTOR OF CUSTOMS,
Port of Biloxi, Miss., December 6, 1898.

SIR: Referring to the request contained in your letter of the 4th instant, for a statement showing the advantages that would accrue to Ship Island Harbor were the pass over the bar deepened to 26 feet at mean low tide, I will, in compliance therewith, be compelled to refer somewhat to that well-known principle of commercial law governing maritime trade, that business is increased or diminished in proportion to the means supplied to insure a safe, speedy, and profitable exchange of commodities. It is, therefore, evident that the consummation of the object you have in view, viz, to assist commerce by removing natural impediments in its way, necessarily imposes upon you, as the General Government's representative in the premises, very great responsibility. The whole matter, however, impinges on two conditions: (1) That the importance of a harbor rests upon the safe anchorage it affords to ships; (2) the business considerations which prompt them to seek the harbor. These two conditions are peremptory and are inseparably connected with the commercial prosperity of any harbor or port. If large-draft vessels, as I understand, can not take on a full cargo inside of Ship Island Harbor and pass over the bar drawing less than 26 feet at mean low tide, but are compelled to take on only a part cargo and then anchor outside on the high seas to finish loading, an expenditure on the part of the General Government to remove the obstacle in the way would be justifiable from a business and commercial standpoint and entirely in consonance with its (Government's) established policy, viz, to foster and encourage trade and commerce when practicable, and to remove all causes opposed to the fulfillment of that policy.

Respectfully, yours,

B. F. LINDSEY,
Deputy Collector of Customs.

Maj. WM. T. ROSSELL,
Major of Engineers, U. S. A.

OFFICE OF THE COLLECTOR OF CUSTOMS,
Port of Biloxi, Miss., December 6, 1898.

SIR: In compliance with your request of the 4th instant, I submit the following statistical statement of the commerce of this port for the fiscal year ending June 30, 1898, as compiled from the records of this office, viz:

	Foreign trade.		Coastwise trade.	
	Vessels.	Tonnage.	Vessels.	Tonnage.
Entered	90	89,899	14	12,054
Cleared	60	62,427	14	10,530

Aggregate number of vessels entered	113
Aggregate tonnage	101,953
Aggregate number of vessels cleared	74
Aggregate tonnage	72,957

Imports, none.

Value of domestic commodities, consisting principally (almost entirely) of timber and lumber exported to foreign countries, $537,218.

The foregoing statement can not be said to show the entire trade of Ship Island Harbor, for the reason that quite a number of vessels anchor and load there but enter and clear at Pascagoula, where the consignees and shippers reside, and are therefore reported in the customs and commercial transactions of that port.

It may be proper for me to add in conclusion that the past fiscal year was one of doubt and uncertainty in maritime trade on account of the war with Spain, and any decrease in the volume of business done during that period as compared with previous years may be ascribed to that cause alone; but, happily, the former equilibrium is being established, and it is confidently predicted that the trade at Ship Island Harbor will assume its former proportions and will go on increasing as it has been from year to year.

As requested by you, I inclose herewith a separate statement showing the advantages (so far as I am capable of judging) to the commerce in Ship Island Harbor were the pass over the bar deepened to 26 feet at mean low tide.

I am, respectfully, yours,

BENJ. F. LINDSEY,
Deputy Collector of Customs.

Maj. WM. T. ROSSELL,
Major of Engineers, U. S. A.

APPENDIX T.

INSPECTION OF THE IMPROVEMENT OF THE SOUTH PASS OF THE MISSISSIPPI RIVER.

REPORT OF MAJOR JAMES B. QUINN, CORPS OF ENGINEERS, INSPECTING OFFICER, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING THERETO.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., July 3, 1899.

GENERAL: I have the honor to report upon the improvement of the South Pass of the Mississippi River during the fiscal year ending June 30, 1899.

The amount of construction required to maintain the jetties in an effective condition during the year was comparatively small.

During the year the dredge boat worked 1,173 hours, or about 49 days of 24 hours each, as follows: 3½ days in the Gulf, beyond the ends of the jetties; 27⅜ days in the jetty channel, and 18⅛ days in South Pass, principally in Grand Bayou Reach.

During the year the legal channel having "a navigable depth of 26 feet" was maintained at the head of South Pass. For forty-five days the channel in that portion of the pass known as Grand Bayou Reach was less than 26 feet deep. This shoaling was caused by sand waves, which in recent years have given considerable trouble and caused much delay to commerce.

With the exception of three days the required channel was maintained "through the jetties" at the mouth of South Pass.

Herewith is the report of Mr. O. Donovan, assistant engineer, with five charts to accompany the same. The report is in detail and contains much interesting information.

The following are copies of certified statements upon which payments were made to the contractors:

United States inspecting officer's certificates for maintenance of channel at the mouth and head of South Pass of the Mississippi River, and also "through the pass itself," as designated by acts of Congress approved March 3, 1875 and 1879.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., August 22, 1898.

I certify that between the dates of May 19, 1898, and August 21, 1898, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass, and "through the pass itself," except for three days, during which the required channel was not maintained near the foot of Goat Island.

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers, United States Army.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., November 21, 1898.

I certify that between the dates of August 22, 1898, and November 21, 1898, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass, and "through the pass itself."

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers, United States Army.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., February 24, 1899.

I certify that between the dates of November 22, 1898, and February 24, 1899, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel for three months "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass, and "through the pass itself."

From January 28 to 30, 1899, both dates inclusive, being three days, the jetty channel did not have "a central depth of thirty feet" for a distance of 305 feet.

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers, U. S. Army.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., July 9, 1899.

I certify that between the dates of February 25 and July 9, 1899, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained for three months through the shoal at the head of South Pass and "through the pass itself."

From March 21 to April 7, 1899, both dates inclusive, being eighteen days, and from April 11 to May 7, 1899, both dates inclusive, being twenty-seven days, the channel in that part of South Pass known as Grand Bayou Reach did not contain the required "navigable depth of twenty-six feet."

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers, U. S. Army.

Estimate of funds required for examinations and surveys at South Pass, Mississippi River, during the fiscal year ending June 30, 1901.

1 assistant engineer	$2,700
1 assistant engineer	1,500
1 steam engineer	1,200
1 water-level observer	60
5 seamen	3,320
Rent of office and quarters	300
Mileage and traveling expenses	175
Repairs to launch and boats	430

Supplies for launch and office	$315
Contingencies	2,000
Total	12,000

Money statement.

Amount allotted for fiscal year 1898–99, under act of August 11, 1888	$10,000.00
Amount allotted for fiscal year 1899–1900, under act of August 11, 1888	10,000.00

Statement of expenditures on account of appropriation for examinations and surveys at South Pass, Mississippi River, for the fiscal year ending June 30, 1899, made in compliance with section 4 of river and harbor act of August 11, 1888.

Amount appropriated by act of August 11, 1888	$10,000

EXPENDITURES.

1 assistant engineer, 9-$\frac{22}{30}$ months, at $225	$2,190.00
1 assistant engineer, 11-$\frac{21}{30}$ months, at $125	1,462.51
1 engineer launch, 10-$\frac{23}{30}$ months, at $100	1,076.67
1 first-class seaman, 10-$\frac{23}{30}$ months, at $70	753.67
1 first-class seaman, 10-$\frac{23}{30}$ months, at $65	699.83
1 first-class seaman, 10-$\frac{11}{30}$ months, at $65	673.83
1 first-class seaman, 10-$\frac{3}{30}$ months, at $60	606.00
1 first-class seaman, 23$\frac{1}{4}$ days, at $2	46.50
1 water-level observer, 12 months, at $5	60.00
1 clerk, 1-$\frac{12}{30}$ months, at $125	175.00
1 clerk, 1 month, at $100	100.00
1 clerk, 1 month, at $90	90.00
1 clerk, 2 months, at $75	150.00
1 porter, 1 month, at $50	50.00
Rent of office and quarters, Port Eads, La., 12 months, at $25	300.00
Coal	340.50
Stationery, etc	43.87
Ship chandlery	324.57
Repairs to launch	564.60
Tide-gauge clocks, etc	81.85
Lumber	61.80
Traveling expenses	21.25
Telegrams	6.00
Total	9,878.45

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. C. DONOVAN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., July 1, 1899.

SIR: I have the honor to submit my report for the fiscal year ending June 30, 1899, upon the improvement of the South Pass of the Mississippi River.

The work is being done under a contract contained in an act of Congress approved March 3, 1875, and amended by an act approved March 3, 1879. It is carried on under the direction of Messrs. E. M. Switzer and Estill McHenry, who are the legal representatives of James B. Eads, deceased. They are authorized "to construct such permanent and sufficient jetties and such auxiliary works as are necessary to create and permanently maintain, as hereinafter set forth, a wide and deep channel between the South Pass of the Mississippi River and the Gulf of Mexico."

The following charts accompany the report:

No. 1. Chart of the channel from South Pass Light-House, through the jetties, to deeper water in the Gulf.
No. 2. Chart of a part of South Pass, from South Pass Light-House to Grand Bayou.
No. 3. Chart of a part of South Pass, from Grand Bayou to the head of South Pass.
No. 4. Chart of the Head of the Passes.
No. 5. Plan and comparative profiles of South Pass.

AT THE HEAD OF THE PASSES.

The only structures in this locality which have for many years required any attention are the upper dam and the west T-head, which is the west jetty.

Upper dam.—The east end of this work was strengthened by building a work back of it which gave it a broader foundation, and the dam was built up at other localities where necessary.

The work remained in good condition until June 5, 1899, when 120 feet of the west end gave way and was washed out. The original foundation mattress is still in place, however, and on this that portion of the dam will be rebuilt as soon as the river reaches a low stage.

The remaining 350 feet of this dam is in good condition.

The following materials were used in the work during the year: Twelve piles, 1,134 cords of willows, 44 cubic yards of stone, 43 screw bolts, 214 linear feet of 12 by 12 inch timber, and 2,499 sacks of earth.

West T-head.—This structure was maintained in good condition during the year by the addition of 6 piles, 242 cords of willows, 35 cubic yards of stone, 1,594 linear feet of 12 by 12 inch timber, and 55 screw bolts.

To strengthen this work and protect it from a strong eddy on the west side of it, two wing dams were built at right angles to it and 72 and 218 feet from the upper end. They are 30 and 37 feet long and are of the usual construction, consisting of two rows of piles 9 feet apart, the piles in each row being 6 feet apart, with waling pieces and ties of 12 by 12 inch timber, and between the piles willows weighted with stone or earth in sacks are placed.

The following materials were used in the construction of these dams: Twenty-nine piles, 177 cords of willows, 21 cubic yards of stone, 178 linear feet of 12 by 12 inch timber, and 37 screw bolts.

East T-head extension.—The upper end of this work was reenforced by the addition of 6 piles, 98 cords of willows, 158 linear feet of 12 by 12 inch timber, and 20 screw bolts.

Cut-off dike.—This dike when built closed the waterway between the upper dam and the mainland below it, and is now mostly buried by a deposit of sediment which it caused. In April, 1899, it was threatened to be undermined at a point 114 feet below the upper dam, and 15 piles and 12 cords of willows were used to strengthen it. A wing dam 42 feet long and 9 feet wide had been built at this point to protect the work by breaking a strong eddy. This washed out in April, but was rebuilt at once.

On June 5, at the same time that the end of upper dam gave way, 150 feet of this dike was lost.

The wing dam on the east side of the dike and 370 feet below upper dam was extended 99 feet. In these two dams the following materials were used: Sixty-eight piles, 420 cords of willows, 29 cubic yards of stone, 503 linear feet of 12 by 12 inch timber, 89 screw bolts, and 681 sacks of earth.

Mattress sills across Southwest Pass and Pass a Loutre.—The sill across Southwest Pass, as completed in December, 1878, was 2,840 feet in length, and with the exception of 600 feet, being from 100 to 700 feet from the east end, it is still in place. From 700 to 1,200 feet from the east end it has settled from 3 to 25 feet, and over the remainder of its length the settlement has been quite uniformly 2 to 4 feet.

The sill across Pass a Loutre was completed in May, 1877, and was 3,000 feet long. As nearly as can be ascertained 500 feet of the west end has washed out, and over the remainder there is a deposit of sand which renders the depth of water over the sill less than when it was placed.

The locations of all works at the Head of the Passes are given on chart No. 4.

IN SOUTH PASS.

At a point on the west bank 1,200 feet below the Head of the Passes Light-House, where the shore was cutting away at the end of a small remaining portion of one of the sheet-piling dams, 5 cords of willows and 75 sacks of earth were placed.

In Goat Island Reach.—In this reach four wing dams are maintained in good condition on the east bank of the pass, and required the addition of but 168 cords of willows during the year; these were weighted with loose earth.

In Grand Bayou Reach.—There are seven wing dams projecting from the east bank in this reach which are considered essential and are maintained in good condition. Other and older ones on the west bank of the pass have caused the building out of that shore to such an extent as has rendered their maintenance unnecessary. Five of the 7 dams were repaired during the year, the materials used being 10 piles, 97 cords of willows, 209 linear feet of 12 by 12 inch timber, 21 screw bolts, and loose earth was used as ballast.

At three localities in the pass, where the bank was low and the flow of water over it tended to cut a bayou to the bay, 30 cords of willows and 440 sacks of earth were placed.

The locations of dams in Goat Island and Grand Bayou reaches are given on charts Nos. 2 and 3.

AT THE MOUTH OF SOUTH PASS.

All works referred to at this locality are represented on chart No. 1.

East jetty.—The recession of the land formation east of this jetty, which has been going on for many years, is still active, and in consequence 300 feet of the jetty was uncovered during the year, the shore receding from 200 to 450 feet.

The present condition of this jetty is as follows: For 2,550 feet from East Point, its origin, land has formed over and about it so that it is entirely buried. For the next 3,660 feet it is as originally built of mattresses of willows ballasted with stone, and averages 3½ feet below average flood tide.

The remainder of the jetty is capped by a wall of concrete which was completed in 1889, except 304 feet, in two sections, of older construction which are not now in place. This wall where built upon the original mattress foundation settles quite uniformly, but in places where a new foundation was necessary the settlement has been irregular. Some sections of it are above the plane of average flood tide and others below, the average elevation being 0.27 of a foot below that plane.

From 11,242 to 11,608 feet below East Point there is a section 366 feet long of this wall which remains as orignally built in March, 1879, and in April, 1880, a rubble parapet was built upon it. The average subsidence of this section in the past nineteen years is 6.11 feet, giving an average annual subsidence of 0.32 of a foot.

Another section of this wall which has remained in good condition since it was built in February, 1889, is from 6,248 to 6,855 feet below East Point. In ten years the average subsidence of this section was 0.6 of a foot, or an average annual subsidence of 0.06 of a foot.

These two sections having remained in good condition are taken as those which would give the most satisfactory data relative to subsidence, and they show that the subsidence increases toward the end of the jetty, being five times as much 350 feet from the end of the jetty as it is 5,200 feet from the same point.

West jetty.—The outer 420 feet of this jetty is from 2 to 5 feet below the surface of the water.

For a distance of 2,752 feet above the end of this jetty it is capped by a concrete wall, which was built from January 31 to May 22, 1879. Since February 27, 1880, being a period of nineteen and a quarter years, the extreme outer end has settled 7.8 feet, or an average of about 0.4 of a foot per year, and the average subsidence of the remainder is 5.3 feet, or a rate of 2¾ tenths per year.

This wall and the entire west jetty, as is represented on chart No 1, is below the surface of the land which has formed since it was built.

Inner east jetty.—This work consists of rows of piles, between which willows and stone are placed and spread out so as to give it a base of about 35 feet and a slope on the sea side. At times much heavy driftwood is thrown upon this jetty with damaging effect; to prevent this, also to some extent break the force of heavy seas and make the work more substantial, a row of piles is being driven at the foot of the slope. The piles are from 3 to 4 feet apart, and in a row parallel to and about 42 feet from the river face of the jetty.

The work, although substantial, requires constant attention to keep it in an effective condition.

To keep pace with the recession of the land to the eastward of it, the jetty was continued upstream 400 feet to a point 2,880 feet below East Point. From time to time willows and stone have been added throughout the entire length of the work, and the protection piles at the foot of the slope have been driven for a distance of 3,480 feet.

The following materials were used in the maintenance of this jetty during the year: 10,206 cords of willows, 2,201 cubic yards of stone, 258 linear feet of 12 by 12 inch timber, 30 screw bolts, and 977 piles.

Inner west jetty.—But little work was done on this jetty during the year aside from building up some of the cribs near the sea end. As represented on chart No. 1, the land has formed up to the work, and in connection with the work now in place, makes a very stable bank.

The following materials were used in the maintenance of the work during the year: Sixteen piles, 211 cubic yards of stone, 3,703 linear feet of 12 by 12 inch timber, 7,660 linear feet of 2½ by 12 inch plank, 736 driftbolts, and 18 screw bolts.

Wing dams.—Of the 36 wing dams which are maintained in good condition, 18 were added to or repaired during the year. The following materials were used in the work: Twenty-five piles, 581 cords of willows, 219 cubic yards of stone, 123 linear feet of 12 by 12-inch timber, 3,246 linear feet of 2½ by 12 inch plank, 61 screw bolts, and 200 sacks of ballast material.

DREDGING.

From June 22, 1898, to June 21, 1899, both dates inclusive, the dredge boat worked 1,173 hours, or about 49 days of 24 hours each, as follows: Three and one-half days in the Gulf, beyond the end of the jetties; 27¾ days in the jetty channel; 14¼ days in Grand Bayou Reach, and 3¾ days at two other localities in South Pass.

The dredge has been out of commission since May 8, 1899.

In this connection the dredging record since July 8, 1879, when the period of twenty years' maintenance began, is of interest, and as it is probable that no dredging will be required during the next two weeks, I will bring the record up so as to include a period of twenty years from July 8, 1879, to July 7, 1899, inclusive. During this period the number of 24-hour days' dredging done was as follows: Fifty-four and one-fourth days in the Gulf, beyond the end of the jetties; 325¼ days in the jetty channel; 88¾ days in South Pass, and 1¼ days at the head of South Pass.

This gives an average of 23½ days per year for twenty years, during which time the channel was maintained eighteen and one-half years, and for that period the average would be 25⅖ days per year Therefore, the average result is that during eighteen and one-half years the channel was maintained 340 days each year by the action of the jetties and auxiliary works, and during 25 days of each year it was maintained by the same agency aided by dredging.

From February 22, 1883, to August 2, 1888, being a period of nearly five and one-half years, no dredging was done.

The greatest number of days' dredging done in any one year was during the fiscal year 1896, and was 70¼ days of 24 hours. The average number of days during the past seven years was 42, and during the past four years 53.

THE PLANT.

Repairs were made to the dredge boat, tug, launch, six barges, derrick boat, skiffs, wheelbarrows, wharves, buildings, etc., and 72 mooring piles were driven at different points for the floating plant.

FORCE EMPLOYED.

The average force employed during the year, including all grades, was 47 in number.

EXAMINATIONS AND SURVEYS.

The examinations and surveys which are made from year to year are primarily for ascertaining facts bearing upon the faithful performance by the contractors of their obligations in the premises. At the same time much interesting and valuable scientific data has been compiled.

As the time for the termination of the present contract is near at hand, and anticipating that certain data may be asked for before another report is written, I give as part of it the following table, which contains information relative to payments made for maintenance, the time during which a legal channel has been maintained, etc., and as it is probable that the next payment will be earned July 8, and before this report goes to Washington, I have given the record to include that date, which is twenty years from the time the maintenance period began, and the end of a period of eighteen and a half years' actual maintenance.

The following table gives the number of days from July 8, 1879, to July 8, 1899, both dates inclusive, during which the required channel was maintained through the South Pass of the Mississippi River, the jetty channel at its mouth, and beyond the jetties to deeper water in the Gulf of Mexico, also the number of days during which said channel was not maintained:

Number of days during which channel was maintained. (Full quarter.)	Periods which include a full quarter and the number of days during which the channel was not maintained.		Number of days' deficiency, and locality of same.		
	From—	To—	In South Pass.	In Jetty Channel.	In Gulf of Mexico.
92	July 8, 1879	Oct. 29, 1879		22	
92	Oct. 30, 1879	Feb. 9, 1880		11	
90	Feb. 10, 1880	May 9, 1880			
92	May 10, 1880	Aug. 9, 1880			
366					
92	Aug. 10, 1880	Nov. 9, 1880			
92	Nov. 10, 1880	Feb. 9, 1881			
89	Feb. 10, 1881	May 9, 1881			
92	May 10, 1881	Aug. 13, 1881			4
365					
92	Aug. 14, 1881	Nov. 13, 1881			
92	Nov. 14, 1881	Feb. 13, 1882			
89	Feb. 14, 1882	May 13, 1882			
92	May 14, 1882	Sept. 9, 1882		14	13
365					
91	Sept. 10, 1882	Dec. 9, 1882			
90	Dec. 10, 1882	Mar. 9, 1883			
92	Mar. 10, 1883	June 9, 1883			
92	June 10, 1883	Sept. 9, 1883			
365					
91	Sept. 10, 1883	Dec. 9, 1883			
90	Dec. 10, 1883	Mar. 9, 1884			
92	Mar. 10, 1884	June 9, 1884			
92	June 10, 1884	Sept. 9, 1884			
365					
91	Sept. 10, 1884	Dec. 9, 1884			
91	Dec. 10, 1884	Mar. 9, 1885			
92	Mar. 10, 1885	June 9, 1885			
92	June 10, 1885	Sept. 9, 1885			
366					
91	Sept. 10, 1885	Dec. 9, 1885			
90	Dec. 10, 1885	Mar. 26, 1886		17	
92	Mar. 27, 1886	June 26, 1886			
92	June 27, 1886	Sept. 26, 1886			
365					
91	Sept. 27, 1886	Dec. 26, 1886			
90	Dec. 27, 1886	Mar. 29, 1887	3		
92	Mar. 30, 1887	June 29, 1887			
92	June 30, 1887	Sept. 29, 1887			
365					
91	Sept. 30, 1887	Dec. 29, 1887			
91	Dec. 30, 1887	Mar. 29, 1888			
92	Mar. 30, 1888	June 29, 1888			
92	June 30, 1888	Sept. 29, 1888			
366					
91	Sept. 30, 1888	Jan. 6, 1889		8	
90	Jan. 7, 1889	Apr. 6, 1889			
91	Apr. 7, 1889	July 6, 1889			
92	July 7, 1889	Oct. 11, 1889		5	
364					

Number of days during which channel was maintained. (Full quarter.)	Periods which include a full quarter and the number of days during which the channel was not maintained.		Number of days' deficiency, and locality of same.		
	From—	To—	In South Pass.	In Jetty Channel.	In Gulf of Mexico.
92	Oct. 12, 1889	Jan. 11, 1890			
90	Jan. 12, 1890	Apr. 11, 1890			
91	Apr. 12, 1890	July 11, 1890			
92	July 12, 1890	Oct. 11, 1890			
365					
92	Oct. 12, 1890	Jan. 11, 1891			
90	Jan. 12, 1891	Apr. 14, 1891	3		
91	Apr. 15, 1891	July 26, 1891		12	
92	July 27, 1891	Oct. 26, 1891			
365					
92	Oct. 27, 1891	Jan. 26, 1892			
91	Jan. 27, 1892	Apr. 26, 1892			
91	Apr. 27, 1892	Sept. 19, 1892		32	23
91	Sept. 20, 1892	Dec. 19, 1892			
365					
90	Dec. 20, 1892	Mar. 19, 1893			
92	Mar. 20, 1893	July 21, 1893	32		
92	July 22, 1893	Oct. 21, 1893			
92	Oct. 22, 1893	Jan. 21, 1894			
366					
90	Jan. 22, 1894	Apr. 21, 1894			
91	Apr. 22, 1894	July 30, 1894	9		
92	July 31, 1894	Nov. 11, 1894		12	
92	Nov. 12, 1894	Feb. 11, 1895			
365					
89	Feb. 12, 1895	May 11, 1895			
92	May 12, 1895	Sept. 11, 1895		31	
91	Sept. 12, 1895	Dec. 11, 1895			
91	Dec. 12, 1895	Mar. 11, 1896			
363					
92	Mar. 12, 1896	June 28, 1896	5	12	
92	June 29, 1896	Jan. 28, 1897		122	
90	Jan. 29, 1897	May 13, 1897		11	4
92	May 14, 1897	Sept. 27, 1897	45		
366					
91	Sept. 28, 1897	Dec. 27, 1897			
90	Dec. 28, 1897	May 18, 1898	52		
92	May 19, 1898	Aug. 21, 1898	3		
92	Aug. 22, 1898	Nov. 21, 1898			
365					
92	Nov. 22, 1898	Feb. 24, 1899		3	
89	Feb. 25, 1899	July 8, 1899	45		
6,753	Total		192	312	44

Number of days from July 8, 1879, to July 8, 1899, both dates inclusive	7,306
Number of days in this period during which a legal channel was not maintained	553
Number of days during which a legal channel was maintained	6,753 = 18½ years.

AT THE HEAD OF THE PASSES.

The chart of this survey is No. 4, and from it detailed information relative to the channel may be obtained. As the depth of water over this area is influenced by the stage of the river we find from year to year changes which vary accordingly, but which for many years have been unimportant. The deep channel which was secured in 1879 has remained a permanent feature, and although occasional abnormal shoalings have occurred, more than the required "navigable depth of 26 feet" has been maintained without the aid of dredging.

SURVEY OF SOUTH PASS FROM ITS HEAD TO SOUTH PASS LIGHT-HOUSE.

The charts of this survey are Nos. 2 and 3, and the following table gives the depth and width of channel in the different reaches:

Tabulated statement of the depth and width of channel throughout South Pass of the Mississippi River from East Point to 30-foot depth in the main river, given in separate reaches one-fourth of a mile in length, from a survey made in September and October, 1898.

Locality.		Available depth.	Available width of—	
From—	To above East Point.		26-foot channel.	30-foot channel.
East Point	¼ mile	33	335	115
Above East Point:				
¼ mile	½ mile	31	350	60
½ mile	¾ mile	29	260	(3)
¾ mile	1 mile	32	260	110
First mile	....	....	......	......
1 mile	1¼ miles	30	250	30
1¼ miles	1½ miles	29	270	(4)
1½ miles	1¾ miles	27	350	(5)
1¾ miles	2 miles	28	370	(6)
Second mile	....	27	250	......
2 miles	2¼ miles	29	400	(7)
2¼ miles	2½ miles	30	420	180
2½ miles	2¾ miles	31	390	250
2¾ miles	3 miles	31	395	210
Third mile	....	29	390	......
3 miles	3¼ miles	31	330	150
3¼ miles	3½ miles	29	295	(8)
3½ miles	3¾ miles	29	295	(9)
3¾ miles	4 miles	31	320	115
Fourth mile	....	29	295	......
4 miles	4¼ miles	31	330	180
4¼ miles	4½ miles	31	390	155
4½ miles	4¾ miles	32	375	200
4¾ miles	5 miles	33	280	170
Fifth mile	....	31	280	155
5 miles	5¼ miles	30	275	70
5¼ miles	5½ miles	28	400	(*a*)
5½ miles	5¾ miles	28	305	(*b*)
5¾ miles	6 miles	29	350	(*c*)
Sixth mile	....	28	275	......
Above East Point:				
6 miles	6¼ miles	28	380	(*d*)
6¼ miles	6½ miles	27	330	(*e*)
6½ miles	6¾ miles	29	355	(*f*)
6¾ miles	7 miles	31	360	190
Seventh mile	....	27	330	......
7 miles	7¼ miles	29	295	(*g*)
7¼ miles	7½ miles	31	340	75
7½ miles	7¾ miles	33	310	240
7¾ miles	8 miles	35	255	165
Eighth mile	....	29	295	......
8 miles	8¼ miles	30	240	......
8¼ miles	8½ miles	30	310	90
8½ miles	8¾ miles	32	230	150
8¾ miles	9 miles	33	240	150
Ninth mile	....	30	230	......
9 miles	9¼ miles	33	275	155
9¼ miles	9½ miles	29	375	(*i*)
9½ miles	9¾ miles	36	365	275
9¾ miles	10 miles	46	290	250
Tenth mile	....	29	275	......
10 miles	10¼ miles	34	300	255
10¼ miles	10½ miles	39	330	250
10½ miles	10¾ miles	41	315	234
10¾ miles	11 miles	29.6	230	(*m*)
Eleventh mile	....	29.6	230	......
11 miles	11¼ miles	44	(1)	330
11¼ miles	11½ miles	31	(1)	500
11½ miles	11¾ miles	32	(1)	(1)
11¾ miles	12 miles	(2)	(2)	(2)
Twelfth mile	....	31	(1)	330

(1) Very wide. (2) In Mississippi River, above the Head of the Passes.

Length of the portion of this reach not having a central depth of 30 feet:

	Feet.		Feet.		Feet.
(3)	170	(9)	820	(*f*)	380
(4)	1,020	(*a*)	1,320	(*g*)	565
(5)	1,320	(*b*)	940	(*i*)	570
(6)	1,320	(*c*)	180	(*m*)	160
(7)	200	(*d*)	1,320		
(8)	295	(*e*)	750	Total	11,330

By reference to the comparative profiles on chart No. 5, it will be seen that during the year some reaches deepened and others shoaled, the average result favoring a slight deepening. From these profiles also the great shoaling throughout the pass since 1875 may be studied in detail.

In the 12 miles of channel included in the above table there is eight-tenths of a mile more which has a depth of 30 feet than in November, 1897.

It is required that a channel having "a navigable depth of 26 feet" be maintained through South Pass and the shoal at its head, and such depth was maintained during the year, except for forty-five days, being from March 21 to April 7, and from April 11 to May 7, 1899, inclusive.

On March 21 the stage of river at Carrollton, La., was 13.2 feet; on April 19 it reached its highest stage, 15.9 feet, and on April 27 it began to fall slowly, reaching a stage of 15 feet on May 7.

On March 21 it was found that a sudden shoaling had taken place in Grand Bayou Reach. The shoal was 1,940 feet long, having a depth of 25 feet of water over it at high tide, 23.8 feet at low tide, and 23.5 feet when reduced to the legal plane of reference.

The temporary lodgment of large volumes of heavy sand at a certain stage of the river is a phenomenon with which we are familiar, it having been more or less in evidence for many years. Unfortunately, these shoalings have grown more aggravated during the past four years, causing much annoyance to shipping; and the greater misfortune seems to be that there is no remedy for the evil unless it be to dredge the channel during low river to a sufficient depth as will insure against these shoalings reducing the depth to less than that which commerce requires.

A powerful hydraulic dredge worked on this shoal day after day without the slightest effect so far as improving the channel was concerned; in fact, it was often observed that on each succeeding trip the boat would make the shoaling was increasing. The channel was constantly changing, the changes being identical with those shown on Plate III, Appendix R, of the Report of the Chief of Engineers for 1897.

The dredge had not worked on this shoal for ten days previous to May 8, on which date it was found that the channel had become restored, the shoal disappearing 1 mile below where it first appeared.

It may be inferred that dredging at such times is useless, and such inference is in accord with my observations for many years. While there is no doubt but that a dredge removes much material, the beneficial effect is seldom apparent while sand waves are active; the channel seldom improves until they cease, and then the improvement is generally rapid even when dredging is omitted.

THE CHANNEL THROUGH THE JETTIES.

The channel through the jetties and beyond them to deeper water in the Gulf is shown on chart No. 1. The required channel—"26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width"—was maintained during the year except for three days (January 28, 29, 30, 1899), during which a shoaling caused by sand waves reduced the central depth to less than 30 feet for a distance of 305 feet.

The profiles on chart No. 5 show the changes in depth which occurred during the year, and the following table explains the changes in the depth and width of the channel from month to month during the year.

Available depths and widths of channel through the jetties, in separate reaches of 2,000 feet each, according to surveys made during the fiscal year ending June 30, 1899.

Date.	Distances from East Point, in feet.								
	0 to 2,000.			2,000 to 4,000.			4,000 to 6,000.		
	Available depth.	Available width of channel.		Available depth.	Available width of channel.		Available depth.	Available width of channel.	
		26 feet.	30 feet.		26 feet.	30 feet.		26 feet.	30 feet.
1898.									
July	30.6	290	85	32.6	300	200	32.9	242	185
August	31.5	316	65	33	305	210	32.5	250	170
September	30.4	300	40	31.4	280	160	32.2	240	170
October	30.8	286	60	31	280	122	31.2	250	170
November	32	295	50	31.8	290	104	31.5	240	90
December	31.6	300	56	31.5	258	84	31.7	245	73
1899.									
January	*a* 30.2	250	40	*b* 30.9	295	40	30.8	240	130
February	31.8	310	125	31.4	276	184	30.2	260	50
March	31.4	312	148	31.4	280	170	30.9	240	145
April	32.5	344	190	33.1	312	220	33.8	272	182
May	36	382	210	35	335	210	31	270	190
June	32.7	345	135	36.2	326	242	34.2	260	190

a Depth 29.6 feet on January 28, 29, 30.

b Depth 29.3 feet on January 28, 29, 30.

Available depths and widths of channel through the jetties, etc.—Continued.

Date.	Distances from East Point, in feet.								
	6,000 to 8,000.			8,000 to 10,000.			10,000 to 12,000.		
	Available depth.	Available width of channel.		Available depth.	Available width of channel.		Available depth.	Available width of channel.	
		26 feet.	30 feet.		26 feet.	30 feet.		26 feet.	30 feet.
1898.									
July	33.4	240	180	37.4	250	180	34.6	270	165
August	32.6	255	152	33.6	230	183	32.1	243	150
September	32.2	220	165	35.1	215	165	32.4	240	120
October	31.5	236	155	34.1	240	155	31.5	250	130
November	30.8	220	50	33.1	230	100	32.5	250	140
December	31	228	55	32	225	100	31.3	235	112
1899.									
January	30.5	247	100	33	265	140	33	265	140
February	30.5	250	82	32.9	260	120	32.4	256	155
March	31.2	250	120	33.3	252	138	33.5	250	150
April	33.1	280	190	34.5	267	200	34.2	270	195
May	31	288	183	32	265	200	35	280	220
June	33	236	180	34	273	163	34.5	280	190

The following table contains a record of the depth of this channel before the jetties were built, and from month to month since that time:

Table giving the depths of water through the jetties at various dates.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1875—June	22.5	18.7	16.7	10.2	9.7	9.2
1876—May	23.3	20.8	22	21	17.1	15
August	23.5	19.6	21	23.5	23	19.8
November	22	20.3	21.1	21.2	21.1	20.3
1877—March	24.1	21.1	23.2	22	21.2	20.5
July	24.9	24	26	23.8	23.5	20.3
October 25 to December 14	26.3	24.4	28.5	24.2	23	23.7
1878—March	26	25.9	35.5	25.4	24.8	23
December	28.4	26.4	35.7	27.1	25.3	23
1879—March	28.6	27.5	43.4	27	27	27
June	27.5	28.4	47.7	29.2	29.2	28
July 8	30.5	30.7	....	31	30.7	30.5
December	31	31	48.3	31.7	31.8	30.8
1880—June	31	32.5	47.8	31.4	35.1	32
July	30.5	31	44	30.8	31.5	30.5
August	30.5	30.4	46	32	32	30.5
September	30.7	31	44.4	30.6	32	31
October	31	31.5	41	30.3	31	30.5
November	30.6	31	40.3	30.8	30.9	30.5
December	30.9	30.6	43	30.8	31	30.3
1881—January	30.5	30.4	41.9	33.8	30.7	30.3
February	30.4	30.2	41.6	32	31	30
March	31.5	31.2	41.3	32	32	30.5
April	30.4	30	43	33	33	30.5
May	30.2	30.5	42.7	32.6	30.5	31.2
June	30	30.5	43.8	32	31.7	31.7
July	31	32	42.5	33.5	33	32
August	30.1	32	37.6	32	31	30.2
October	30.2	30.3	38.3	31.4	31.2	30.3
1882—January	30.3	30.4	41.3	31.1	30.2	30.7
February	31.8	36	39.7	30.5	30.8	30.2
March	31.2	30.6	39.2	30.8	31.6	32.5
April	31.7	32.6	39.6	30.5	30.3	33
May	30.5	32.5	39.4	31	31.3	31
June	30.8	35.5	39	31.3	31.3	31
July	30	32.7	38.7	30.6	31.3	31.5

Table giving the depths of water through the jetties at various dates—Continued.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1882—August	30.3	32.2	38.1	31.8	31.8	30.5
September	30.1	31.5	38.3	31.9	30.8	30.5
October	30	31	37.1	31	31.4	31.2
November	30	32	38.1	21.5	31.2	31.2
December	31	31	37	31.2	31	30.4
1883—January	31	31	35.2	30.2	30.1	30.1
February	31.2	31.2	36	30.5	30	30.1
March	32.3	32.6	45.7	31.5	30.8	30.3
April	33.7	35	44	32.2	30	30
May	33.2	36.3	46	32.3	30.3	32.4
June	32.5	34.2	45	33.4	31	33
July	33.8	34.9	44	32	31.5	31.8
August	32.1	38.2	48	33.4	33.4	32.2
September	33.4	34.3	46	32.3	32.3	30.6
October	32.7	34.1	41.5	32	32	30.5
November	31	33.8	43.8	34.5	31.5	31
December	30.5	32.6	43	31.6	31.6	30.2
1884—January	31.2	32.2	39.2	32.7	31.8	30.3
February	32	31.5	41.3	31.6	31	30.7
March	35.7	39.5	41.6	34	33.8	38.7
April	35.3	37.3	41.5	31.7	32.7	35.4
May	34.9	35.8	42.8	34.3	35.1	33
June	35	35.8	41.1	34	35	35
August	31.9	35.8	41.9	33.9	35	32
September	32	34	39	33.1	33.7	33.5
October	31.1	33.4	38.6	32.6	32.6	32.5
November	32.8	32.8	37.2	32.2	32.4	30.8
December	31.6	32.6	37.1	31.1	31.5	31.4
1885—January	36.7	36.4	36.9	33.1	34.6	32.8
February	41.7	36.3	35.7	30.5	34.1	36.2
March	35.5	36	36.1	31	31.7	35.7
April	36	35.5	37	32	32.6	32
May	36.7	35	35.6	31.5	33.5	31.5
June	34.7	33.7	35.7	32.8	32.8	31.3
July	36.3	33.1	36.5	33.7	33.6	31
August	36.5	36.6	37.6	33	32	31
September	35.3	33.3	35.2	32.2	30.7	31.7
October	33.8	33.7	35.8	31.3	30.4	30.4
November	32.7	32.8	35.1	30.8	30.6	30.1
December	33	32.2	34.2	30.9	30.5	30.6
1886—January	33.6	32.5	33	30.2	30.2	28.5
February	32.8	32.8	34.1	31.3	30.9	30
March	32.8	35.8	34	35	33.1	32
April	35.4	34.5	34.5	33.7	33.7	31
May	35.9	35.6	34.2	31	36	34.4
June	38.2	35.2	33.4	33.2	34.5	36.5
July	36.7	36.7	36.2	32.8	32.7	37
August	35	36	35.7	34.8	33.8	34.7
September	34.5	35.6	34.6	33.7	33.6	33
October	35	36.2	34.4	33	34.1	33
November	34.5	35.6	34.8	32.9	33	33.5
December	34	35	35.3	33.6	32.6	33
1887—January	33.6	34	33.3	32.3	32.7	33.4
February	36.4	34.4	35.4	31.3	34.1	32.4
March	35.5	35.5	32.6	35.5	35.5	33.8
April	38.8	37	33.7	31	34.8	35.5
May	39.4	35.3	37.1	31.2	34.2	38.1
June	39	35.4	37.5	32.3	34.1	35.2
July	39	36.4	35.8	34	32	34
August	35.7	34.6	34.7	33.6	31.6	32.7
September	36	34	35	35	32.7	32.2
October	36.2	34.2	34.3	32.1	32.2	31.8
November	35.9	32.9	33.8	30.7	31.8	31.2
December	34.7	32.7	33.9	30.9	31.7	31.8
1888—January	35.6	32.5	33.7	30.5	31.5	32.2
February	34.3	32.4	32.5	31	31	32
March	34	33	32.6	30.5	31.3	30.9
April	36.3	34.8	33.8	31	35	31.4
May	35.2	35.2	34.3	31.6	33.6	33
June	32	33	33	31.4	35.5	33.2
July	34.2	34	33.8	31	31.9	33.6
August	33.7	33.7	33.7	31.2	31.2	33.2
September	32.7	32.7	32.8	30.8	31	32
October	33.3	33.6	32.3	30.6	30.4	30.4
November	31.8	32.8	31.7	30.6	30.6	30.8
December	31.4	32.4	31.6	30.3	a 29.2	30.7

a From December 28, 1888, to January 4, 1889, inclusive.

Table giving the depths of water through the jetties at various dates—Continued.

Date.	Distances from East Point, in feet.					
	0 to 2,000	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1889—January	31	31.3	30.6	30.3	31	30.9
February	32.4	32.5	31.8	32.8	31	32.5
March	30.2	32.2	30.4	32.3	31.8	31.6
April	30.8	32.1	31.2	32.8	32.8	30.6
May	30.8	32	30.7	32.6	31.2	30.8
June	30.4	32.2	31.3	31.5	31	30.8
July	30.3	31	31	32.4	31.8	31
August	31.7	31.4	31.5	31.6	31.4	31
September	30.9	31.3	31.2	31	31.1	....
October	31.6	31	31.2	31	31.7	[a]29.6
November	31	31.2	31.2	31	31.3	31.4
December	30.8	31	31.2	31	31.7	31.2
1890—January	30.8	30.8	31.2	30.6	31	31
February	31.7	30.7	31.5	32.6	34.4	33
March	36.4	33.2	34	34	34	33.6
April	33.4	36	35	35	38.7	34.5
May	32	34	34	36	39	34
June	32	33.5	33	34	39.8	35
July	32.4	33.4	34	34	39	37
August	32	33	33	32.7	35	34
September	30.5	31.4	33	33	35	33
October	32	31	31	30.5	34	32.8
November	30.6	31.2	30.6	30.6	34	33
December	31.5	31.2	30.7	30.7	32.3	33.5
1891—January	31	31	31.2	32.2	32.3	32.5
February	31.7	31	31.4	32.5	35.2	32.7
March	32	34.3	36.4	37.5	36	34.6
April	30.5	32	36.5	39	36.4	34.2
May	30.3	32	32	35	36	34
June	33	31.1	32	34.7	37	35
July	31.4	30.4	30.4	33.3	35.8	34.8
August	31	31	31	32.3	32.9	31.4
September	30.6	30.6	30.7	31	31.5	....
October	31	30.8	30.8	31.2	31.2	30.7
November	31.2	31	31.3	31.2	31.1	30.6
December	30.1	30.3	30.6	31.4	31.3	32
1892—January	31.3	31.6	31.3	31.3	31.8	32.2
February	30.5	30.8	30.8	31	31.1	31.7
March	30.8	30.7	31.4	31.7	31.2	31
April	32	32	33.7	32	30.5	30.6
May	[b]28.1	[d]29.6	33	35	33	32
June	[c]30.4	32.3	36	37	36.6	33.2
July	31.5	33	32	35.6	38	34.2
August	31.5	33.5	33.8	34.6	34.8	35
September	31.2	32.7	31.2	33.6	33.7	33.5
October	31.8	32.5	31.8	31.5	32.7	32.3
November	31.5	32.1	31.5	32	33	32.6
December	31	31.5	31.6	32.1	33.5	33.1
1893—January	31.6	32.2	31.3	32.1	32.2	34.1
February	31.6	31.6	31	31.6	32.7	34
March	33.6	34.6	33.1	30.8	51.2	32.4
April	33.6	35	33.6	31.6	32.3	32.6
May	32	34	33	33	32.5	32
June	32.7	33	33.8	36	31.7	30.5
July	32	33.3	34	35	36.7	35
August	32	32	34	34.5	35.3	34.2
September	31.5	31.5	32.4	33.5	35.3	31.8
October	31.5	32.2	32.7	33.2	34.2	33.2
November	31.4	32.7	33.3	32.8	34.3	33
December	31	32	33	33	34.8	33.5
1894—January	32.1	32.1	33.5	33.2	36.8	34.5
February	30.6	32.2	32.6	32.6	34.5	33
March	32.8	31.8	31.7	32	34.2	34
April	34.8	31.4	32.7	33	32.3	34
May	32	32	34	34	34	33
June	32.2	31.2	32.9	33	32.7	33.6
July	32.1	31.6	31.7	31.5	31.8	32.6
August	31.2	30.5	31.2	30.2	[e]28.9	30.3
September	31.3	30.6	30.6	30.5	30.3	30.5
October	30.4	30.4	30.1	30.8	30.6	30.4

[a] From October 1 to October 5, inclusive.

[b] Depth less than 30 feet from April 25 to May 6, both dates inclusive, and varied from 27.5 to 29.4 feet.

[c] Depth less than 30 feet from May 20 to June 20, both dates inclusive, and varied from 28.1 to 29.6 feet.

[d] From December 28, 1888, to January 4, 1889, inclusive.

[e] August 20 to 31, both dates inclusive.

Table giving the depths of water through the jetties at various dates—Continued.

Date.	Distances from East Point, in feet.					
	0 to 2,000	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1894—November	30.3	30.3	30.6	30.3	30.8	30.8
December	30.8	30.6	31.3	30.7	30.7	30.7
1895—January	31.7	32.1	32.1	31.6	31.5	31.9
February	31.9	32.4	31.7	31.8	31.8	31.8
March	32.8	32.1	31.6	31.6	31.7	32.2
April	32	31.9	31.5	31.6	31.8	32.2
May	31.4	31.5	31.4	31.4	31.9	31.6
June	31.1	31.7	31.6	31.3	31.3	31.5
July	31.7	31.7	32	31.5	31.8	32.1
August	32.2	31.8	31.8	31.3	31.1	31.4
September	31.8	31.7	31.8	31.4	31.4	31.4
October	30.9	30.9	31.8	31.3	31.5	31.2
November	31.7	31.5	31.8	31.3	32.1	32.1
December	31.3	31.4	33.1	31.4	31.9	31.2
1896—January	31.3	30.9	32.1	31.9	31.3	32.4
February	31.3	31.1	31.3	31.3	31.5	31.5
March	30.6	30.3	30.5	31.1	32	32
April	30.5	30	30.3	30.4	31	31.9
May	30.3	30	30.2	30	31	32.4
June	30.2	30.2	*a* 30.2	*a* 30.2	*a* 30.2	32.2
July	30.3	30.7	30.4	30.4	31.1	31.1
August	*b* 29.3	29.3	*b* 29	*b* 29	*b* 29.4	30.2
September	30.2	29.4	30.3	29	29.9	30.1
October	30.2	30.3	30.6	30.5	30.4	30.2
November	30.8	30	30	30.4	30.3	30.4
December	30.7	30.7	31.1	30.8	30.9	31.1
1897—January	30.4	30.5	31.2	30.5	30.4	30.6
February	30	30.2	30	30	30.2	31
March	30.5	30.4	30	30.3	30.6	31.8
April	*c* 30.5	30.6	31.4	31.6	32.2	33.1
May	32	32	32	33	35	34
June	30.4	31.7	33.2	35	36	39
July	30.8	31.6	33.1	35	35	34
August	31.3	30.9	33	35.3	35.7	32.2
September	30.1	31	31.6	30.7	32.5	30.5
October	30.4	30.3	30.5	31.7	34	31.3
November	30.9	30.5	31	30.8	33.4	32.2
December	31.5	31.4	31.3	32	32.9	32.4
1898—January	31.3	30.7	30.4	31.7	32.7	32.4
February	30.5	30.6	30.7	30.7	32.8	32.5
March	....	....	....	....	....	....
April	31.6	32.5	30.7	*d* 30.3	34.3	32.2
May	33	34	34	34	32	33
June	32.6	33.5	34.3	34.1	37.1	34.7
July	30.6	32.6	32.9	33.4	37.4	34.6
August	31.5	33	32.5	32.6	33.6	32.1
September	30.4	31.4	32.2	32.2	35.1	32.4
October	30.8	31	31.2	31.5	34.1	31.5
November	32	31.8	31.5	30.8	33.1	32.5
December	31.6	31.5	31.7	31	32	31.3
1899—January	*e* 30.2	30.9	30.8	30.5	33	33
February	31.8	31.4	30.2	30.5	32.9	32.4
March	31.4	31.4	30.9	31.2	33.3	33.5
April	32.5	33.1	33.3	33.1	34.5	34.2
May	36	35	31	31	32	35
June	32.7	36.2	34.2	33	34	34.5

a Less than 30 feet from June 15 to 18, both inclusive.
b Less than 30 feet from August 17 to October 21, both inclusive.
c Less than 30 feet from April 16 to 20, both inclusive.
d Less than 30 feet from April 25 to 28, both inclusive.
e Less than 30 feet on January 28, 29, 30.

IN THE GULF, BEYOND THE ENDS OF THE JETTIES.

During the fall, winter, and early spring months exceptionally unfavorable weather prevented my making the usual survey beyond the ends of the jetties to ascertain what changes had occurred there during the year. This, however, is a matter of no importance, since with the data now at hand, covering a period of twenty-one years (see plate 6, Appendix T, of the Annual Report of the Chief of Engineers for 1898), we may, with a considerable degree of accuracy, locate in the future the distance of any depth from the ends of the jetties.

The data on the plate referred to established pretty conclusively what result a certain stage of river will effect, other conditions remaining as at present, and while a progressive building seaward of the Gulf bottom is established beyond any question, yet its progress has not been even what the most conservative investigator believed it would be.

It will be seen that the advance of the curves from the 20-foot to the 60-foot one, inclusive, is from 12¼ to 66⅔ per cent less from 1887 to 1897 than during the previous ten years, and that the rate of advance of the 70, 80, 90, and 100 foot curves is practically the same during both periods. The following table gives the results:

Year.		Designation of curve and number of feet each has advanced.								
From—	To—	20-foot.	30-foot.	40-foot.	50-foot.	60-foot.	70-foot.	80-foot.	90-foot.	100-foot.
1877..........	1887..........	51	55	67	71	99	110	97	92	92
1887..........	1897..........	15	39	36	53	86	106	98	95	102

It is shown also that since 1893 the 20, 30, 40, and 50 foot curves have receded, the 60-foot one advanced slightly, while the 70, 80, 90, and 100 foot ones show about their normal advance, and it will be ascertained that during the 20 years from 1877 to 1897 the average annual advance of each curve is as follows:

Year.		Designation of curve and number of feet advanced.								
From—	To—	20-foot.	30-foot.	40-foot.	50-foot.	60-foot.	70-foot.	80-foot.	90-foot.	100-foot.
1877..........	1897..........	33	47	52	62	92	108	97	94	97

The average annual advance of the curves from 20 to 50, inclusive, is 48 feet, or less than one-half of what was considered the annual advance of the bar, and the average of those from 60 to 100, inclusive, is 98 feet, which is practically the rate established for the advance of South Pass Bar.

While indisputable evidence of bar advance exists, there is also evidence that it has not been augmented by the jetties, but that it has been retarded by them within an area prescribed by the 50-foot depth, and when it is considered how slight the average vertical height of this annual building up is, and where the greater portion of it is taking place, and when we consider that in twenty-four years since the jetties were built it has not been necessary to extend them any farther seaward, we may well concern ourselves with the more difficult problem of preserving the channel of the pass above the jetties.

VELOCITY, TIDAL, AND SEDIMENT OBSERVATIONS.

In previous reports abundance of data is published relative to these observations. They were continued during the year, and the more important results are contained in the following tables:

Table giving the tidal readings on gauges, Port Eads and East Bay, the former being in South Pass and the latter in a bay to the westward of South Pass, and is so situated as to give Gulf-level readings.

Lunation.		Port Eads gauge.		East Bay gauge.		Difference at—		Rise and fall of tide—	
From—	To—	High tide.	Low tide.	High tide.	Low tide.	High tide.	Low tide.	At Port Eads.	In East Bay.
1895.	1895.								
July 27	Aug. 22	3.858	2.544	3.592	2.172	0.266	0.372	1.314	1.420
Aug. 23	Sept. 18	3.994	2.776	3.810	2.430	.184	.346	1.218	1.380
Sept. 19	Oct. 16	4.378	3.210	4.128	2.812	.250	.398	1.168	1.316
Oct. 17	Nov. 12	3.922	2.662	3.806	2.352	.116	.310	1.260	1.454
Nov. 13	Dec. 9	3.634	2.189	3.530	1.884	.104	.305	1.445	1.646
	1896.								
Dec. 10	Jan. 6	3.567	2.166	3.323	1.760	.244	.406	1.401	1.563
Mean........		3.892	2.591	3.698	2.235	.194	.356	1.301	1.463
1896.	1896.								
Jan. 7	Feb. 2	3.841	2.421	3.452	1.839	.389	.582	1.420	1.613
Feb. 3	Feb. 29	3.618	2.394	3.158	1.758	.460	.636	1.224	1.400
Mar. 1	Mar. 28	3.518	2.436	3.059	1.753	.459	.683	1.082	1.306
Mar. 29	Apr. 24	3.915	2.704	3.348	1.967	.567	.737	1.211	1.381
Apr. 25	May 22	4.074	2.729	3.671	2.128	.403	.601	1.345	1.543
May 23	Juue 18	4.358	2.907	3.969	2.405	.389	.502	1.451	1.564
June 19	July 15	4.158	2.679	3.764	2.166	.394	.513	1.479	1.598
July 16	Aug. 11	3.868	2.528	3.492	2.028	.376	.500	1.340	1.464
Aug. 12	Sept. 8	3.944	2.782	3.604	2.319	.340	.463	1.162	1.285
Sept. 9	Oct. 5	4.075	2.972	3.837	2.600	.238	.372	1.103	1.237
Oct. 6	Nov. 2	4.105	2.963	3.797	2.487	.308	.476	1.142	1.310
Nov. 3	Nov. 29	4.209	2.858	3.970	2.465	.239	.393	1.351	1.505
Nov. 30	Dec. 26	3.978	2.518	3.613	1.989	.365	.529	1.460	1.624
Mean........		3.974	2.684	3.595	2.146	.379	.537	1.290	1.449
1896.	1897.								
Dec. 27	Jan. 22	4.032	2.666	3.661	2.140	.371	.526	1.366	1.521
1897.									
Jan. 23	Feb. 19	3.958	2.699	3.459	2.072	.499	.627	1.259	1.387
Feb. 20	Mar. 18	3.981	2.870	3.294	2.118	.687	.752	1.111	1.176
Mar. 19	Apr. 14	4.377	3.295	3.699	2.334	.678	.961	1.082	1.365
Apr. 15	May 12	4.461	3.364	3.644	2.346	.817	1.018	1.097	1.298
May 13	June 8	4.604	3.316	3.879	2.335	.725	.981	1.288	1.544
June 9	July 5	4.164	2.731	3.769	2.199	.395	.532	1.433	1.570
July 6	Aug. 2	4.053	2.749	3.731	2.343	.322	.406	1.304	1.388
Aug. 3	Aug. 29	3.881	2.639	3.630	2.318	.251	.321	1.242	1.312
Aug. 30	Sept. 25	4.142	3.022	3.838	2.591	.304	.431	1.120	1.247
Sept. 26	Oct. 23	4.246	3.181	4.059	2.785	.187	.396	1.065	1.274
Oct. 24	Nov. 19	4.020	2.749	3.898	2.517	.122	.232	1.271	1.381
Nov. 20	Dec. 16	3.985	2.595	3.908	2.279	.077	.316	1.390	1.629
	1898.								
Dec. 17	Jan. 13	3.656	2.302	3.454	1.963	.202	.339	1.354	1.491
Mean........		4.111	2.870	3.709	2.310	.402	.560	1.241	1.399
1898.	1898.								
Jan. 14	Feb. 9	4.128	2.823	3.628	2.168	.500	.655	1.305	1.460
Feb. 10	Mar. 8	4.205	3.085	3.626	2.293	.579	.792	1.120	1.333
Mar. 9	Apr. 4	4.126	3.027	3.616	2.389	.510	.638	1.099	1.227
Apr. 5	May 2	4.191	3.068	3.489	2.118	.702	.950	1.123	1.371
May 3	May 29	4.374	3.095	3.670	2.240	.704	.855	1.279	1.430
May 30	June 25	4.484	3.130	4.011	2.475	.473	.655	1.354	1.536
June 26	July 23	4.429	3.114	3.912	2.598	.517	.516	1.315	1.313
July 24	Aug. 19	4.219	3.011	3.952	2.576	.267	.435	1.208	1.376
Aug. 20	Sept. 15	4.430	3.330	4.109	2.725	.321	.605	1.100	1.384
Sept. 16	Oct. 13	4.540	3.521	4.378	3.139	.162	.382	1.019	1.239
Oct. 14	Nov. 9	4.294	3.027	3.941	2.537	.353	.490	1.267	1.404
Nov. 10	Dec. 6	4.308	2.872	3.963	2.502	.345	.370	1.436	1.461
	1899.								
Dec. 7	Jan. 2	3.909	2.447	3.490	1.947	.419	.500	1.462	1.543
Mean........		4.279	3.042	3.829	2.439	.450	.603	1.237	1.390
Grand mean.		4.091	2.829	3.709	2.290	.382	.539	1.262	1.419

Table giving the mean elevation of the surface of the water at high, low, and mean tides at the Head of the Passes and Port Eads, also the slope and mean velocity of the current of South Pass, and Carrollton gauge record, from 1877 to 1899.

Year.	Head of Passes.			Port Eads.		
	High tide.	Low tide.	Mean.	High tide.	Low tide.	Mean.
1877	2.436	1.542	1.989	2.741	1.586	2.163
1878	2.994	2.291	2.642	3.056	1.892	2.474
1879	2.548	1.720	2.134	2.961	1.763	2.362
1880	2.993	2.221	2.607	3.158	1.979	2.568
1881	2.982	2.199	2.590	3.147	2.004	2.575
1882	(*a*)	(*a*)	(*a*)	3.362	2.288	2.825
1883	3.287	2.588	2.937	3.349	2.332	2.840
1884	3.125	2.358	2.741	3.359	2.304	2.831
1885	3.041	2.300	2.670	3.339	2.291	2.815
1886	2.848	2.065	2.456	3.276	2.221	2.748
1887	2.590	1.717	2.153	3.232	2.203	2.717
1888	3.032	2.292	2.622	3.522	2.389	2.955
1889	2.792	1.900	2.346	3.546	2.381	2.963
1890	3.466	2.701	3.083	4.001	2.826	3.413
1891	3.297	2.331	2.814	3.951	2.673	3.312
1892	3.479	2.633	3.056	4.012	2.716	3.364
1893	3.337	2.364	2.850	3.985	2.649	3.317
1894	3.107	2.055	2.581	3.894	2.521	3.207
1895	2.630	1.516	2.073	3.686	2.371	3.028
1896	3.083	2.161	2.622	3.974	2.684	3.329
1897	3.371	2.507	2.939	4.111	2.870	3.490
1898	3.607	2.809	3.201	4.279	3.042	3.600

Table giving the mean elevation of the surface of the water at high, low, and mean tides at the Head of the Passes and Port Eads; also the slope and mean velocity of the current of South Pass, and Carrollton gauge record, from 1877 to 1899—Continued.

Year.	Slope of South Pass.			Mean velocity of current, in feet per second.	Carrollton gauge.[b]		
	High tide.	Low tide.	Mean.		1.	2.	3.
1877	0.975	1.236	1.105	....	5.178	11.06	11.80
1878	1.218	1.679	1.448	....	6.546	10.80	11.40
1879	.827	1.242	1.049	2.73	4.682	10.60	10.80
1880	1.115	1.522	1.319	3.45	7.376	13.74	14.25
1881	1.105	1.472	1.289	3.35	7.308	12.25	12.50
1882	....	....	....	....	....	14.72	14.95
1883	1.218	1.536	1.377	3.31	8.920	14.70	15.40
1884	1.046	1.334	1.190	3.35	8.282	15.09	15.60
1885	.982	1.289	1.135	3.38	7.210	12.25	13.55
1886	.852	1.136	.987	3.20	6.648	13.61	13.70
1887	.638	.794	.716	2.81	4.977	11.95	14.50
1888	.788	1.183	.947	3.15	6.199	12.72	14.00
1889	.532	.799	.663	2.89	6.038	10.37	11.50
1890	.745	1.156	.950	3.20	8.127	15.58	16.10
1891	.627	.938	.782	2.80	7.092	14.99	16.00
1892	.748	1.195	.971	3.08	7.940	16.30	17.20
1893	.632	.994	.818	2.78	7.239	15.93	17.45
1894	.493	.804	.664	2.20	5.196	12.91	13.50
1895	.224	.425	.325	1.74	2.498	6.96	10.15
1896	.390	.767	.574	2.51	5.266	10.56	13.65
1897	.540	.917	.729	2.98	6.859	18.52	19.00
1898	.607	1.047	.827	3.08	6.945	14.48	15.90

[a] No record.

[b] Column 1 gives the mean reading of the gauge for the year; column 2 gives the mean reading of the gauge for a lunation giving the highest mean; column 3 gives the extreme height of the river during the year.

THE NAVIGATION OF THE CHANNEL.

During the year I reported the grounding of eight steamers, two of which ground in the Gulf beyond the ends of the jetties, and the mishaps were attributed to and storm; they were drawing but 20½ and 23 feet.

Of the other six, one grounded 3¼ miles below the Head of the Passes. Her ste swung to the bank with great force, encountering some obstruction which disabl her rudder, and she was towed back to New Orleans for repairs. She was drawin 26⅛ feet. The other five grounded in Grand Bayou Reach, four of them while sa waves were active and the channel difficult to navigate. In one case a rudder wa disabled by coming in contact with a wing dam and in another instance the rudder was lost after the steamer had proceeded to sea some 8 miles.

Some of these steamers and others experienced considerable delay through having to wait at the Head of the Passes until the channel in Grand Bayou Reach deepened sufficiently to afford safe navigation for them.

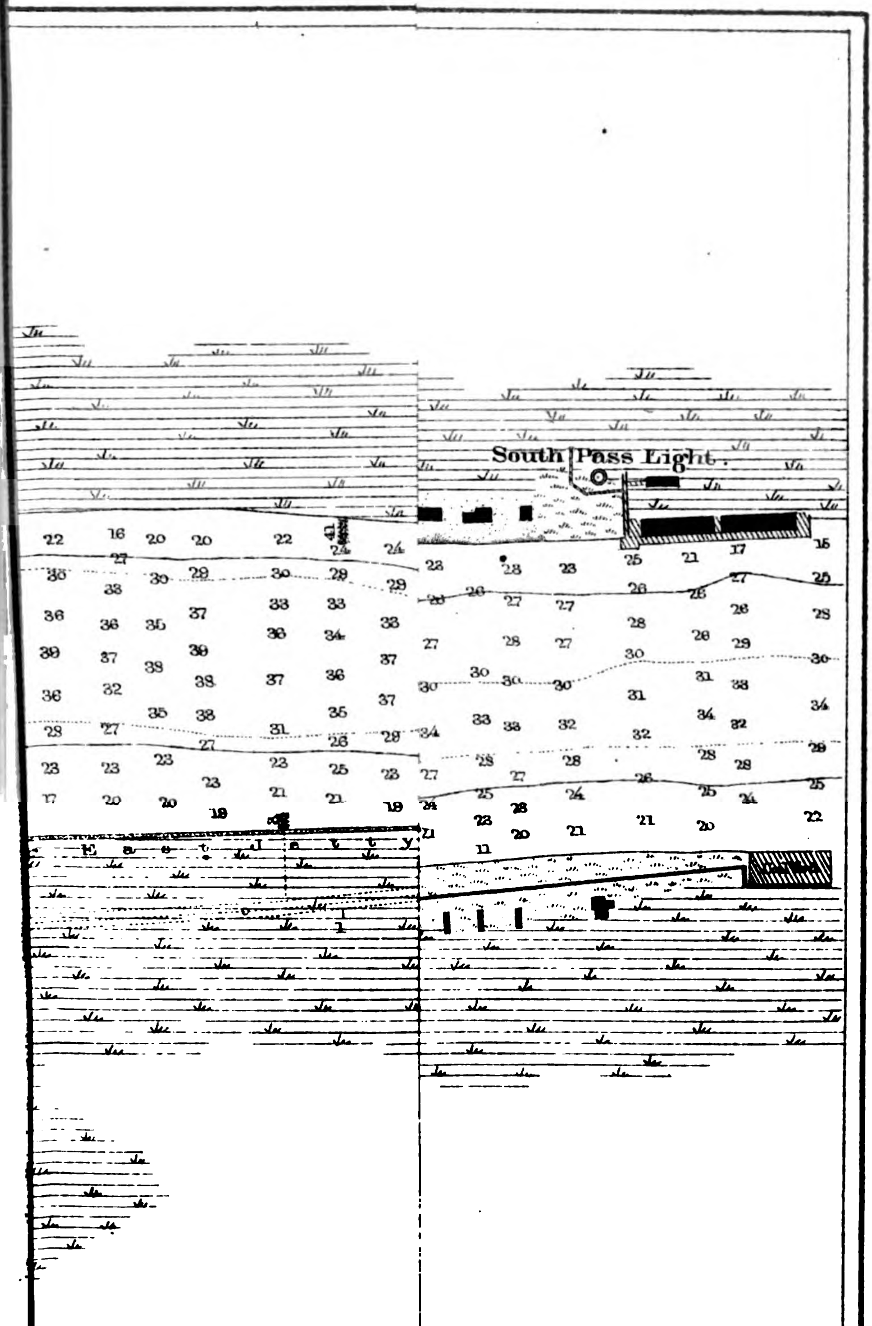
CONCLUSION.

During the year I was ably assisted by Mr. G. W. Lawes, assistant engineer, whom I hereby commend.

Very respectfully, your obedient servant,

C. Donovan, *Assistant Engineer.*

Maj. James B. Quinn,
Corps of Engineers, U. S. A.



t for the year ending June 30,1899

James B. Quinn

Major, Corps of Eng'rs. U.S.A.

GUGGENHEIMER, WEIL & CO. PHOTO.-LITHO. BALTIMORE.

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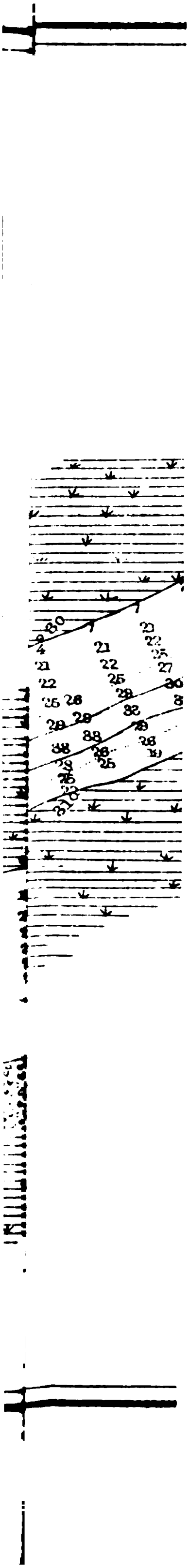

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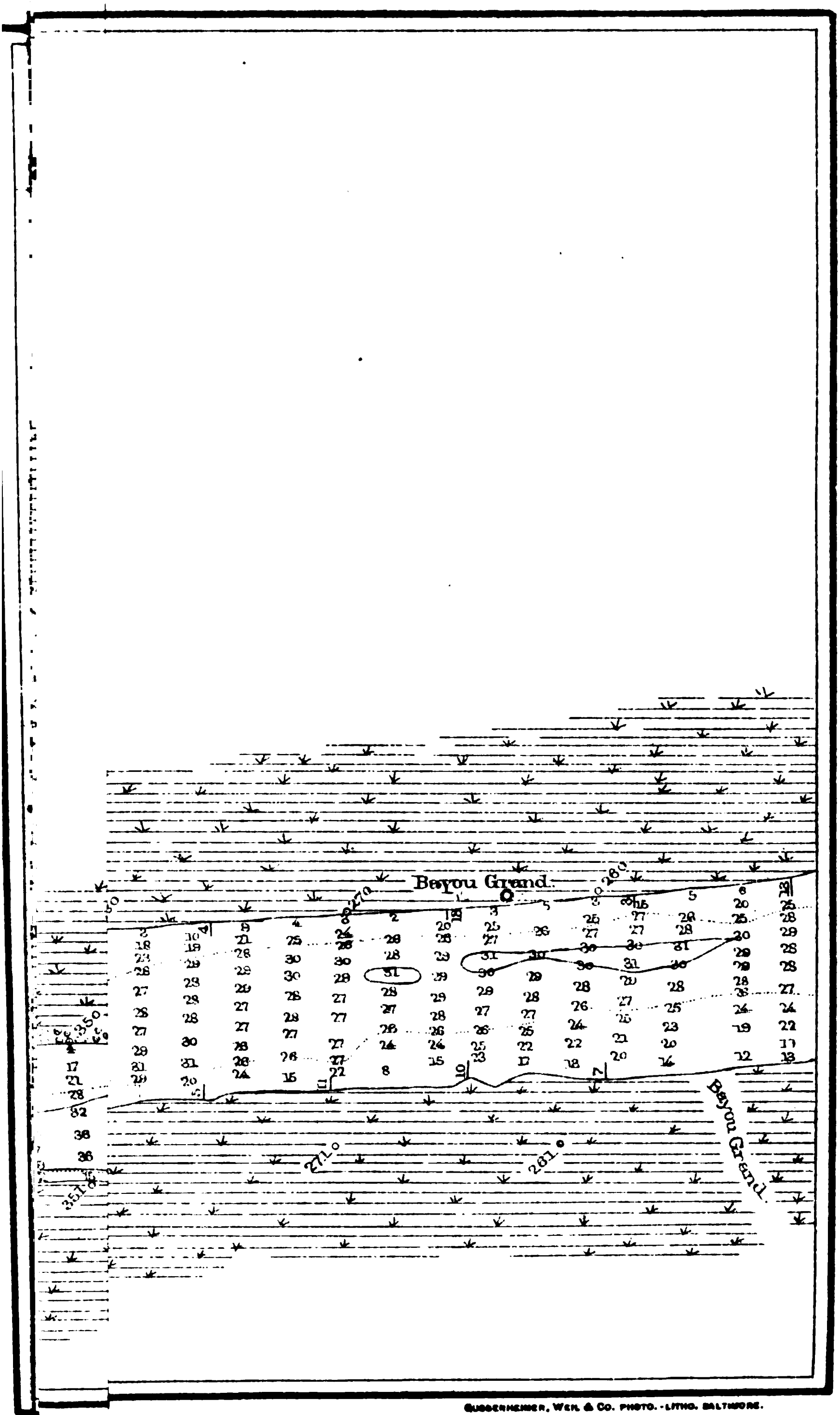

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GUGGENHEIMER, WEIL & CO. PHOTO.-LITHO. BALTIMORE.

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APPENDIX U.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS, AND OF HOMOCHITTO RIVER, MISSISSIPPI.

REPORT OF MAJOR JAMES B. QUINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Chefuncte (Tchefuncte) River and Bogue Falia, Louisiana.
2. Tickfaw River and tributaries, Louisiana.
3. Amite River and Bayou Manchac, Louisiana.
4. Closing crevasse in Pass a Loutre, Mississippi River.
5. Outlet of Mississippi River at Pass a Loutre.
6. Bayou Lafourche, Louisiana.
7. Bayou Plaquemine, Grand River and Pigeon bayous, Louisiana.
8. Bayou Courtableau, Louisiana.
9. Bayou Teche, Louisiana.
10. Channel, bay, and passes of Bayou Vermilion, Louisiana.
11. Mermentau River and tributaries, Louisiana.
12. Mouth and passes of Calcasieu River, Louisiana.
13. Johnsons Bayou, Louisiana.
14. Removing water hyacinths from Louisiana waters.
15. Sabine and Neches rivers, Texas.
16. Sabine River, Texas.
17. Harbor at Sabine Pass, Texas.
18. Homochitto River, Mississippi.

SURVEY.

19. Southwest Pass, Mississippi River.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., July 15, 1899.

GENERAL: I have the honor to forward herewith annual report upon works of river and harbor improvement at present under my charge for the fiscal year ending June 30, 1899.

* * * * * * *

Very respectfully, your obedient servant,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

U 1.

IMPROVEMENT OF CHEFUNCTE (TCHEFUNCTE) RIVER AND BOGUE FALIA, LOUISIANA.

No work was done on these streams during the past fiscal year. For details of the improvement see Annual Report of the Chief of Engineers for 1896, page 1485.

The river and harbor act of March 3, 1899, appropriated $1,000 for maintenance. Under project approved March 24, 1899, it is contemplated to dredge out the bars at the mouth of the Tchefuncte and in the Bogue Falia to obtain a 6-foot channel 60 feet wide through them.

Proposals for hire of dredge boat were invited, but none were received, and on June 23, 1899, authority was obtained from the Chief of Engineers to hire a boat in open market at not to exceed $50 per day of eight hours. Arrangements are being made to carry out the improvement at an early date.

About $1,000 annually will be required to maintain the improvement.

Money statement.

July 1, 1898, balance unexpended	$1,106.21
Amount appropriated by river and harbor act approved March 3, 1899	1,000.00
	2,106.21
June 30, 1899, amount expended during fiscal year	45.54
July 1, 1899, balance unexpended	2,060.67
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	1,000.00

Abstract of appropriations for improving Chefuncte (Tchefuncte) River and Bogue Falia, Louisiana.

By act of Congress—	
Approved March 3, 1881	$1,500
Passed August 2, 1882	1,500
Approved August 5, 1886	2,500
Approved September 19, 1890	1,000
Approved July 13, 1892	1,000
Of August 18, 1894	1,000
Passed June 3, 1896	1,000
Approved March 3, 1899	1,000
Total	10,500

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	14
Trips	943
Net registered tonnage (943 trips) ... tons	78,068
Schooners	29
Trips	459
Net registered tonnage (459 trips) ... tons	15,819
Barges	15
Trips	255
Tonnage (255 trips) ... tons	37,200
Total vessels	58
Total trips	1,657
Total tonnage ... tons	131,087

Draft of heaviest vessel, light, 5.2 feet; loaded, 7 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber, shingles, laths	47,911	$141,258	34,067	$144,521
Bricks	15,280	33,316	15,650	34,430
Sand	23,081	23,081	32,937	16,468
Wood	978	1,956	100	200
Cotton	502	56,252	499	59,880
Rice	52	2,393	57	2,170
Miscellaneous	63	485	146	4,848
Sheep, cattle, horses	114	9,938	65	3,767
Tar, rosin, turpentine	1,897	71,468	2,707	61,283
Sirup	104	1,806	105	3,090
Wool	3	1,080	4	1,434
Total	89,985	343,033	86,337	332,091
RECEIPTS.				
Merchandise	9,520	380,800	11,452	400,802
Grand total	99,505	723,833	97,789	732,893

Comparative statement of receipts and shipments for nine years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	45,521	$201,061	1896	67,680	$621,454
1892	50,054	354,684	1897	110,034	632,894
1893	30,284	429,126	1898	99,505	723,833
1894	242,464	919,699	1899	97,789	732,893
1895	49,778	850,111			

U 2.

IMPROVEMENT OF TICKFAW RIVER AND ITS TRIBUTARIES, LOUISIANA.

For the improvement of Tickfaw River and its tributaries (Natalbany, Blood, and Ponchatoula rivers) a project was adopted in 1881 which provided for keeping the streams in a navigable condition as far as possible by the removal of obstructions. The estimated cost was $10,230.

With appropriations aggregating $10,000, about 30 miles of the Tickfaw River and tributaries were improved up to the heads of navigation.

A detailed report of progress of the work will be found in the Annual Report of the Chief of Engineers for 1896, pages 1488–1489.

Under the appropriation of $1,000, made June 3, 1896, it was attempted to remove the water hyacinths which clogged the streams, but the plants floated in almost as fast as they were removed. See Annual Report of Chief of Engineers for 1897, pages 1753–1754.

On March 3, 1899, an appropriation of $1,000 was made for maintenance of the improvement, and a subproject was approved on March 24, 1899, for the removal of obstructions in the streams as far as funds will permit.

Proposals covering the improvement were opened on June 8, 1899, and on June 27 the Chief of Engineers authorized the execution of a contract with George T. Wibel and Peter Usner for the hire of a snag boat at $29.50 per day of eight hours. A contract is being prepared, and operations will be commenced as soon as practicable.

It is estimated that $1,000 will be required annually, exclusive of the removal of the water hyacinths.

Money statement.

July 1, 1898, balance unexpended	$242.49
Amount appropriated by river and harbor act approved March 3, 1899	1,000.00
	1,242.49
June 30, 1899, amount expended during fiscal year	36.16
July 1, 1899, balance unexpended	1,206.33
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	1,000.00

Abstract of appropriations for improving Tickfaw River and tributaries, Louisiana.

By act of Congress—

Approved March 3, 1881	$2,000
Passed August 2, 1882	2,000
Approved August 5, 1886	2,000
Of August 11, 1888	1,000
Approved September 19, 1890	1,000
Approved July 13, 1892	1,000
Passed August 18, 1894	1,000
Passed June 3, 1896	1,000
Approved March 3, 1899	1,000
Total	12,000

Abstract of proposals for furnishing boat, labor, and material for snagging, for improving Tickfaw River, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 8, 1899.

No.	Name and address of bidder.	Bid per day of 8 hours.	Total for 30½ days.
1	Geo. T. Wibel and Peter Uaner, New Orleans, La.	$29.50	$899.75

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	5
Trips	382
Net registered tonnage (382 trips) ... tons	11,123
Schooners	25
Trips	260
Net registered tonnage (260 trips) ... tons	5,032
Barges	2
Trips	5
Tonnage (5 trips) ... tons	200
Total vessels	32
Total trips	647
Total tonnage ... tons	16,355

Draft of heaviest vessel: Light, 5 feet; loaded, 6.6 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Wood	3,855	$8,989	4,028	$9,056
Lumber	66,282	203,162	44,770	154,390
Brick	150	333	150	330
Cotton	158	17,696	125	20,970
Miscellaneous	28	1,968	738	27,677
Total	70,473	232,148	49,811	212,423
RECEIPTS.				
Merchandise	5,106	204,240	3,150	126,000
Grand total	75,579	436,388	52,961	338,428

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	13,994	$169,643	1897	58,115	$336,370
1894	40,003	251,774	1898	75,579	436,388
1895	23,384	220,566	1899	52,961	338,428
1896	72,851	353,246			

U 3.

IMPROVEMENT OF AMITE RIVER AND BAYOU MANCHAC, LOUISIANA.

The original project for this improvement was adopted in 1880 and modified in 1883. Under this project snagging and dredging operations were carried on to May 31, 1895, from the mouth of Amite River to Wards Creek, and a turning basin for boats was made at the mouth of Wards Creek. For a history of the improvement see pages 1490–1491, Annual Report of the Chief of Engineers for 1896.

With appropriations of $2,500, made June 3, 1896, and $2,500, made March 3, 1899, it is contemplated to remove the obstructions in Amite River and Bayou Manchac which have formed since 1895, under subproject approved March 24, 1899.

Proposals for hire of dredge for making these improvements were opened on June 8, 1899, and on June 27, 1899, the Chief of Engineers authorized the acceptance of the bid of the Dilworth-Scudder Dredging Company, at $50 per day of eight hours each. Contract will be shortly entered into.

No work was done on these streams during the past fiscal year. It will require $2,500 annually to maintain the improvement.

Money statement.

July 1, 1898, balance unexpended	$2,716.04
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	5,216.04
June 30, 1899, amount expended during fiscal year	34.81
July 1, 1899, balance unexpended	5,181.23
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Abstract of appropriations for improving Amite River and Bayou Manchac, Louisiana.

By act of Congress—	
Approved June 14, 1880	$8,000
Approved March 3, 1881	5,000
Approved August 5, 1886	2,000
Of August 11, 1888	5,000
Approved September 19, 1890	3,800
Approved July 13, 1892	2,500
Of August 18, 1894	2,500
Passed June 3, 1896	2,500
Approved March 3, 1899	2,500
Total	33,800

Abstract of proposals for dredging, for improving Amite River and Bayou Manchac, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 8, 1899.

No.	Name and address of bidder.	Bid per day of 8 hours.	Total for 90 days.
1	Dilworth-Scudder Dredging Co., New Orleans, La.	$50	$4,500

This bid authorized to be accepted June 27, 1899. Contract will be shortly entered into.

COMMERCIAL STATISTICS.

[June 1, 1898, to May 31, 1899.]

Steamers		10
Trips		539
Net registered tonnage (539 trips)	tons..	17,059
Schooners		48
Trips		325
Net registered tonnage (325 trips)	tons..	7,120
Barges		2
Trips		40
Tonnage (40 trips)	tons..	2,310
Total vessels		60
Total trips		904
Total tonnage	tons..	26,489

Draft of heaviest vessel: Light, 6 feet; loaded, 7 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber, shingles, laths	35,060	$125,299	30,038	$122,298
Wood	10,456	19,418	10,662	21,324
Staves	1,260	6,156	13,747	476,401
Sugar and molasses	17	660	24	730
Cotton and cotton seed	1,996	134,064	1,366	92,116
Miscellaneous	153	8,600	156	7,772
Total	48,942	294,197	55,993	720,641
RECEIPTS.				
Merchandise	5,807	222,280	4,312	172,480
Grand total	54,749	516,477	60,305	893,121

Comparative statement of receipts and shipments for nine years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	17,792	$300,963	1896	55,103	$414,245
1892	18,530	384,061	1897	49,509	516,443
1893	22,099	346,257	1898	54,749	516,477
1894	157,902	796,305	1899	60,305	893,121
1895	42,983	491,216			

Increase of 1899 over 1898, 5,556 tons, representing a value of $376,644.

U 4.

CLOSING CREVASSE IN PASS A LOUTRE, MISSISSIPPI RIVER.

Act of Congress approved February 26, 1897, appropriated $250,000 for the closure of this crevasse, under which a project was approved on June 16, 1897.

For details of the progress of this work to June 30, 1898, see page 1487 of the Annual Report of the Chief of Engineers for 1898.

A contract for closing the crevasse was entered into on October 29 and approved December 10, 1897. Work began December 14, 1897, and on January 27, 1898, there were 2,400 feet of the dam completed. On account of high water, the contractors were compelled to cease work, and an extension of time was granted them to October 31, 1898. On January 27, 1898, a portion of the sheet-piling dam washed out, and on August 5, 1898, the time the contractors resumed operations, the break extended from 32 to 541 feet from angle, 509 feet, and on the line angle to F, 54½ feet of sheet piling and 66½ feet of rear bracing had been lost from the east end.

A supplemental contract was entered into with the contractors on April 19 and approved June 14, 1898, for additional work on the dam at original contract prices, this work being rendered necessary by the destruction of part of the completed dam and the scour of the current necessitating the use of longer piling in some places.

Another supplemental contract was entered into on August 29, 1898, reducing the supplemental contract of April 19 and allowing the substitution of 40-foot piling rear bracing for 20-foot sheet-piling bracing. This supplemental contract was also rendered necessary on account of change of depth of water in the crevasse.

Work was resumed on August 5, 1898. The depth of water through the breaks (shown on chart attached to Report for 1898) made it necessary to build around these places, hence the line Y to range No. 2 was adopted, and in connection with the line from Y to D the closure was made.

The work progressed satisfactorily, and by October 29, 1898, it was completed from Y to D. (See chart accompanying.)

On October 20 work on the line Y to range No. 2 was completed 750 feet from Y and 660 feet from range No. 2, and between these termini was more or less incomplete work. Several severe storms occurring at this time damaged the work, rendered progress difficult, and caused an increase in the depth of water where the work was not finished.

Work was continued from range No. 2 westward, and as the opening decreased the current became more rapid, rendering the work more difficult. The final closure was made in building a section 232 feet in length from 1,280 to 1,512 feet from range No. 2, where the depth of water had been increased and was from 20 to 31 feet. This section required special piles, the sheet piles being made from those of shorter lengths, and were from 50 to 61 feet long; the brace piles, from 52 to 68 feet long, were specially ordered. Fifteen clusters of mooring piles were driven about 125 feet above the dam, and to them and the dam fifteen ⅞-inch wire cables were attached to support the dam from 1,011 to 1,702 feet from range No. 2, a distance of 691 feet.

The final completion of the work was effected at 10.30 p. m. on November 13, 1898. At that time it seemed that the closure would prove a permanent success, notwithstanding the high stage of the river. A severe storm arose that night, and at 5 a. m. on November 14 the dam gave way at two sections and went out from 1,237 to 1,339 feet from range No. 2, a length of 102 feet, and from 1,506 to 1,574, 68 feet. Eight of the fifteen wire cables supporting the work parted.

Referring to the chart, the work from Y to D is in excellent condition, and at present it appears that it will remain so. The distance is 4,054⅝ feet, and from Y to range No. 2 is 2,334½ feet, making a total length of 6,388$\frac{1}{12}$ feet. With the exception of 642 feet, being from 1,105 to 1,747 feet from range No. 2, the work is in place, the portion lost being about 10 per cent of the whole. From 750 to 1,005 feet from range No. 2, a length of 255 feet, the work is effective, although it is out of line and appears weak. The remaining 5,491$\frac{1}{12}$ feet is in excellent condition.

By reference to the attached chart information may be had relative to the depth of water above the dam and through the break. Also the location of the work, and the remaining portions of previous work.

The depth of water immediately above the dam is from 5 to 13 feet less than when it was built. In some cases the shoaling is greater below the dam than above it, though it is generally less, and particularly from 1,000 to 2,300 feet west of Y, where the shoaling is 3 feet less below the dam than above it. This, however, is close to the work, and probably due to the overflow, for a short distance farther from the work the depth is much less.

The depth in the break is very great, and a good deal of wreckage appears to be stranded in this space. The bottom is exceedingly soft, and has but little supporting power for piles or any weighty structure. The ends of the break should be secured in some manner, and a method of effecting this will be devised. The $20,000 available will not be sufficient to effect the closure, however, and a new project covering the changed conditions will be prepared so soon as the low-water stage of the river will permit the necessary examination of the areas in rear of the dam to be examined. It is estimated that $30,000 additional will be required to close the break in Pass a Loutre Dam.

Survey af Southwest Pass, Mississippi River.—This survey was made under act of February 17, 1898, allotting $10,000 from the appropriation for closing crevasse in Pass a Loutre. The survey was practically completed on April 15, 1898, but a small party was then organized to take daily discharge measurements of the Passes. This work was completed on August 21, 1898, and all maps and data prepared. The Board held meetings at New Orleans on November 30, 1898, and January 7, 1899. The final report on the survey was submitted on January 7, 1899.

Money statement.

July 1, 1898, balance unexpended	$179,327.18
June 30, 1899, amount expended during fiscal year	156,584.04
July 1, 1899, balance unexpended	22,743.14
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	30,000.00

Abstract of appropriations for closing crevasse in Pass a Loutre, Mississippi River.

By act of Congress approved February 26, 1897	$250,000

Of this amount $10,000 was allotted by act of February 17, 1898, for survey of Southwest Pass, Mississippi River.

U 5.

IMPROVEMENT OF THE OUTLET OF THE MISSISSIPPI RIVER AT PASS A LOUTRE.

Under the appropriation of $200,000 made by act of March 3, 1899, a project for the construction of a sill across Pass a Loutre, Mississippi River, with recommendation for allotment of funds appropriated, was submitted to the Chief of Engineers on May 22, 1899. Plans and specifications for the construction of the two dredges authorized are being prepared.

The act of March 3, 1899, further provides that continuing contracts may be entered into for these improvements, not to exceed $300,000, exclusive of the amount therein appropriated.

The following is the estimated cost of the proposed improvement:

For two dredges	$300,000	
Less amount appropriated	150,000	
Balance to be appropriated		$150,000
For sill across Pass a Loutre	166,000	
Less amount appropriated	50,000	
Balance to be appropriated		116,000
For operating two dredges and contingencies		34,000
Total amount to be appropriated		300,000

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$200,000.00
July 1, 1899, balance unexpended	200,000.00
Amount (estimated) required for completion of existing project	300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	300,000.00

Abstract of appropriations for improving the outlet of the Mississippi River.

By act of Congress approved March 3, 1899	$200,000

U 6.

IMPROVEMENT OF BAYOU LAFOURCHE, LOUISIANA.

With appropriations aggregating $30,000, obstructions in Bayou Lafourche were removed, under the original project of 1879, up to 1885. The project of June 11, 1886, as modified September 23, 1896, provided for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf.

Under these projects over 70 miles of channel have been improved, greatly improving the navigation of the stream. The improvement is not permanent, however, as sand bars form each year after the subsidence of the floods in the Mississippi River.

For details of the progress of the work see Annual Report of the Chief of Engineers for 1896, pages 1493 and 1494; also Annual Report for 1898, pages 1468 and 1469.

Under contract with Mr. Frank Beck, of New Orleans, La., approved July 23, 1898, for dredging in the bayou, 126,005 cubic yards of material was removed, and 199 obstructions, including the wrecks of several coal barges. The dredge worked from July 23, 1898, to January 21, 1899, during which interval a greater part was at double time. The channel through the bars was restored so as to preserve low-water navigation.

Act of March 3, 1899, appropriated $7,500 for maintenance of this improvement. The subproject approved May 10, 1899, proposes to devote the balance to the credit of this appropriation to the continuation of dredging for the improvement of low-water navigation in the bayou. Proposals for the work are now being invited, and will be opened July 19, 1899.

An annual appropriation of $25,000 will be necessary so long as the improvement is confined to dredging to maintain low-water navigation.

Money statement.

July 1, 1898, balance unexpended	[1] $42, 979.70
Amount appropriated by river and harbor act approved March 3, 1899	7, 500.00
	50, 479.70
June 30, 1899, amount expended during fiscal year	17, 072.53
July 1, 1899, balance unexpended	33, 407.17
July 1, 1899, outstanding liabilities	15.09
July 1, 1899, balance available	33, 392.08
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	25, 000.00

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[1] Balance of $42,779.70, reported in last Annual Report as unexpended July 1, 1898, was in error. Amount should have been $42,979.70.

Abstract of appropriations for improving Bayou Lafourche, Louisiana.

By act of Congress—	
Approved June 13, 1878	$10, 000
Approved March 3, 1879	10, 000
Approved June 14, 1880	5, 000
Approved July 5, 1884	5, 000
Of August 11, 1888	50, 000
Approved September 19, 1890	50, 000
Approved July 13, 1892	50, 000
Of August 18, 1894	40, 000
Passed June 3, 1896	25, 000
Approved March 3, 1899	7, 500
Total	252, 500

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	29
Trips	688
Net registered tonnage (688 trips) tons	107, 320
Luggers	38
Trips	38
Net registered tonnage (38 trips) tons	315
Barges	123
Trips	138
Tonnage (138 trips) tons	78, 065
Total vessels	190
Total trips	864
Total tonnage (864 trips) tons	185, 700

Draft of heaviest vessel: Light, 3 feet; loaded, 9 feet.

NOTE.—Not included in the above tonnage are 65 flatboats regularly employed in the bayou carrying freights to and from railroads at three different transfers, and carrying freights to and from the steamboats at the head of the bayou during the prevalence of low water.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Sugar	67, 553	$4, 368, 785	43, 864	$3, 377, 400
Molasses	25, 438	590, 640	28, 966	877, 770
Rice	2, 646	107, 274	4, 903	200, 446
Potatoes and onions	6, 646	154, 800	8, 445	73, 439
Eggs	131	15, 747	165	16, 506
Moss	359	14, 368	272	10, 894
Pecans	13	1, 990	29	4, 606
Miscellaneous	474	12, 168	725	19, 229
Total	103, 260	5, 265, 772	82, 369	4, 580, 290
RECEIPTS.				
Miscellaneous	51, 883	1, 721, 161	51, 947	1, 724, 706
Coal	114, 255	380, 850	72, 200	248, 868
Grand total	269, 398	7, 367, 783	206, 516	6, 553, 864

Comparative statement of receipts and shipments for nine years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	217,278	$8,244,226	1896	229,891	$5,629,237
1892	171,885	5,660,662	1897	217,292	4,968,875
1893	212,476	7,422,285	1898	269,398	7,867,783
1894	273,686	8,842,942	1899	206,516	6,553,864
1895	263,607	9,224,554			

U 7.

IMPROVEMENT OF BAYOU PLAQUEMINE, GRAND RIVER, AND PIGEON BAYOUS, LOUISIANA.

For convenience of reference, the operations under this improvement are divided into subheadings.

For a history of the improvement and details of work done see Annual Report of the Chief of Engineers for 1896, pages 1496–1500; for 1897, pages 1759, 1760; for 1898, pages 1471, 1472.

The sundry civil act of June 4, 1897, appropriated $350,000, and the act of March 3, 1899, appropriated $400,000 for continuing the improvement. A project for the expenditure of this amount was approved on June 2, 1899, and provided for the completion of the present continuous contract for construction of lock and approaches, $501,757.60; for improving Grand River, Louisiana, $25,000; for enlarging bed of Bayou Plaquemine, Louisiana, from the railroad bridge to deep water below Dardennes Bend, $222,012.40, and for purchase of a narrow strip of land at Dardennes Bend, in connection with the rectification of the bayou, $1,230.

GRAND RIVER, AND PIGEON BAYOUS.

These streams form part of the Plaquemine all-water route, and were added to this improvement by act of July 13, 1893.

Under project approved June 2, 1899, specifications have been prepared, and proposals will shortly be invited for dredging in Grand River.

BANK-PROTECTION WORK.

During the past year no caves of consequence have occurred in the banks of the Mississippi River near Bayou Plaquemine.

PLAQUEMINE LOCK.

The foundation for this lock was completed December 31, 1897, under contract with Mr. E. A. Burriss, of New Orleans, La., dated June 24, 1895.

Contract was entered into May 28, 1898, and approved June 17, 1898, with Stewart & Co., of St. Louis, Mo., for constructing the lock and approaches. This work to be done under the provisions of the continuing-contract system contained in act of June 3, 1896. The amount of Stewart & Co.'s contract was $501,757.60.

The contractors occupied considerable time in assembling and erecting an extensive plant and the assembling of materials. Preliminary work was commenced on August 15, 1898. The contractors were first engaged in removing the earth that had slumped back into the pit of the lock and in restoring the alignment of the sheet piling which had been driven in by pressure. The amount of earth excavated was 24,460 cubic yards. Laying of concrete commenced in June, and by the end of that month one layer had been placed on the bottom of the invert for a width of 30 feet and for a distance extending from the river end of the lock to the pump well; a second layer was also partly laid.

Under the modified project of April 10, 1899, proposals for excavating, for enlarging the bed of Bayou Plaquemine from the railroad bridge to deep water below Dardennes Bend, to give a low-water channel 125 feet wide and 10 feet deep, were opened on June 8, 1899. On June 28, 1899, the Chief of Engineers authorized acceptance of the bid of Charles Clarke & Co., of Galveston, Tex., at 0.1398 cents per cubic yard. The distance covered by the proposed improvement is 5.08 miles, and it is estimated that 1,027,509 cubic yards will be removed.

Proposals for furnishing the operating machinery and power house for the lock were opened on June 15, 1899, but all bids were authorized to be rejected, as no funds for this work are now available, and it was deemed desirable to give further consideration to plans, specifications, and estimates of cost.

The amount of commerce during the past fiscal year was $173,262.

Money statement.

July 1, 1898, balance unexpended		$377,744.88
Amount appropriated by sundry civil act approved March 3, 1899		400,000.00
		777,744.88
June 30, 1899, amount expended during fiscal year		23,551.51
July 1, 1899, balance unexpended		754,193.37
July 1, 1899, outstanding liabilities	$2,725.49	
July 1, 1899, amount covered by uncompleted contracts	490,586.40	
		493,311.89
July 1, 1899, balance available		260,881.48
Amount (estimated) required for completion of existing project		428,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.		260,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Abstract of appropriations for improving Bayou Plaquemine, Louisiana.

By act of Congress—	
Of August 11, 1888	$100,000
Approved September 19, 1890	100,000
Approved July 13, 1892	150,000
Of August 18, 1894	110,000
Of June 3, 1896	20,000
By sundry civil act approved—	
June 4, 1897	350,000
March 3, 1899	400,000
Total	1,230,000

Abstract of proposals for excavating for improving Bayou Plaquemine, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 8, 1899.

No.	Name and address of bidder.	Price bid per cubic yard.	Total bid. (Basis 1,027,509 cubic yards.)
		Cents.	
1	Rittenhouse Moore Dredging Co., Mobile, Ala	16	$164,401.44
2	Rogers & Wright, New Orleans, La	17.9	a 183,924.11
3	Chas. Clarke & Co., Galveston, Tex	13.98	143,645.76
4	Christie, Lowe & Heyworth, Chicago, Ill	27	274,427.43

a Informal. No internal-revenue stamps affixed to guaranty.

Bid of Charles Clarke & Co. accepted June 28, 1899. Contract will shortly be entered into.

Abstract of proposals for operating machinery and power house, for lock, for improving Bayou Plaquemine, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 15, 1899.

No.	Name and address of bidder.	Amount of bid.
1	Otis Elevator Co., New York, N. Y	a $91,500
2	Henry R. Worthington, New York, N. Y	96,800

a Informal; telegraphic bid.

All bids rejected, as no funds were available for the work at present.

CONTRACTS NOW IN FORCE FOR IMPROVING BAYOU PLAQUEMINE, LOUISIANA.

For constructing lock and approaches for improving Bayou Plaquemine, Louisiana: Name of contractors, Stewart & Co., St. Louis, Mo.; date of approval, June 17, 1898; preliminary operations commenced in August, 1898; contract work commenced February 2, 1899. The entire work under contract to be completed on or before June 30, 1903.

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	7
Trips	123
Net registered tonnage (123 trips) .... tons..	3,694
Barges	3
Trips	77
Tonnage (77 trips) .... tons..	3,850
Total vessels	10
Total trips	200
Total tonnage (200 trips) .... tons..	7,544

Draft of heaviest vessel: Light, 2 feet; loaded, 4 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
Miscellaneous	1,795	$3,300	460	$7,800
Lumber, shingles, etc	74,831	135,408	88,841	165,462
Total	76,626	138,708	89,301	173,262

Comparative statement of receipts and shipments for eight years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1892	181,875	$1,343,608	1896	92,379	$284,175
1893	78,756	1,174,750	1897	57,055	209,586
1894	183,752	535,677	1898	76,626	138,708
1895	120,542	1,110,130	1899	89,301	173,262

Increase of 1899 over 1898, 12,675 tons, representing a value of $34,554.

U 8.

IMPROVEMENT OF BAYOU COURTABLEAU, LOUISIANA.

The original project for the improvement of this bayou was adopted in 1879, and provided for the establishment of slack-water navigation to Washington, La., a distance of 28 miles, and for the removal of a sand bar at the junction with Atchafalaya River. With appropriations aggregating $36,200, work was carried on under this project to November 9, 1895.

For a detailed history of the progress of the work, see Annual Report of the Chief of Engineers for 1896, pages 1501–1502.

Since 1896 the bayou has been completely obstructed by an accumulation of logs at the mouth, which extends back about 3 miles. Proposals have been invited for removing this raft, but up to the present time the funds available were insufficient for the accomplishment of this purpose.

The river and harbor act of March 3, 1899, appropriated $20,000 for the removal of the raft and preventing its re-formation. Under project approved April 7, 1899, it is contemplated to construct a floating boom across the mouth of the bayou to prevent the entrance of drift from the Atchafalaya, and to remove the raft so as to restore navigation.

Proposals for doing the work were opened June 22, 1899, and on June 29, 1899, the Chief of Engineers authorized the acceptance of the bid of Joseph Edward Crusel, of New Orleans, La., for $18,085. Contract will be entered into as early as practicable.

Money statement.

July 1, 1898, balance unexpended	$3,223.29
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	23,223.29
July 30, 1899, amount expended during fiscal year	211.43
July 1, 1899, balance unexpended	23,011.86
July 1, 1899, outstanding liabilities	22.23
July 1, 1899, balance available	22,989.63

Abstract of appropriations for improving Bayou Courtableau, Louisiana.

By act of Congress—

Approved June 14, 1880	$7,500
Approved March 3, 1881	7,500
Approved July 5, 1884	4,000
Approved August 5, 1886	5,000
Passed August 11, 1888	5,000
Approved September 19, 1890	2,200
Passed August 18, 1894	5,000
Passed June 3, 1896	2,500
Approved March 3, 1899	20,000
Total	58,700

Abstract of proposals for removing raft and constructing log boom, for improving Bayou Courtableau, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 22, 1899.

No.	Name and address of bidder.	For log boom.	Removing raft.	Total.
1	Joseph Edward Crusel, New Orleans, La.	$585.00	$17,500.00	$18,085.00
2	Victor von Schoeler, Bay St. Louis, Miss.	2,992.50	15,997.50	18,990.00

On June 29, 1899, the Chief of Engineers authorized the acceptance of bid of Joseph Edward Crusel. Contract will shortly be entered into.

COMMERCIAL STATISTICS.

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1890	85,867	$4,629,584	1894	9,195	$485,811
1891	82,618	3,917,344	1895	4,095	160,787
1892	20,041	994,471	1896	1,994	103,944
1893	14,848	677,529			

Because of the formation of a raft at its mouth, entirely obstructing navigation, there has been no commerce on Bayou Courtableau during the fiscal years 1896-97, 1897-98, and 1898-99.

U 9.

IMPROVEMENT OF BAYOU TECHE, LOUISIANA.

Prior to 1886 Bayou Teche contained numerous obstructions, such as snags and logs. The work of improvement was commenced during 1886, and was carried on at intervals until March 22, 1897, with appropriations aggregating $71,000. The improvement has been of great value to commerce, by the removal of obstructions and dredging of shoal places, for a distance of over 70 miles. The relief, however, is not permanent, as obstructions continue to form.

A history of the progress of the work will be found in Annual Report of the Chief of Engineers for 1896, pages 1503 and 1504. See also Annual Report for 1897, page 1764.

No work was done on Bayou Teche during the past fiscal year.

The river and harbor act of March 3, 1899, appropriated $10,000 for continuing this improvement. The subproject approved April 8, 1899, provides for removing obstructions from the bayou, under contract.

Proposals for doing the work are being invited and will be opened July 19, 1899.

Money statement.

July 1, 1898, balance unexpended	$360.53
Amount appropriated by river and harbor act approved March 3, 1899	10,000.00
	10,360.53
June 30, 1899, amount expended during fiscal year	55.60
July 1, 1899, balance unexpended	10,304.93
July 1, 1899, outstanding liabilities	14.81
July 1, 1899, balance available	10,290.12

Abstract of appropriations for improving Bayou Teche, Louisiana.

By act of Congress—

Approved July 11, 1870	$17,500
Approved June 14, 1880	6,000
Approved March 3, 1881	20,000
Approved July 5, 1884	6,500
Approved September 19, 1890	5,000
Passed August 18, 1894	6,000
Passed June 3, 1896	10,000
Approved March 3, 1899	10,000
Total	81,000

COMMERCIAL STATISTICS.

[From June 30, 1898, to May 31, 1899.]

Steamers		26
Trips		1,148
Net registered tonnage (1,148 trips)	tons	130,440
Barges		175
Trips		1,114
Tonnage (1,114 trips)	tons	172,241
Total vessels		201
Total trips		2,262
Total tonnage (2,262 trips)	tons	302,681

Draft of heaviest vessel: Light, 2½ feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Sugar	40,037	$2,727,487	44,738	$3,427,524
Molasses	3,443	78,074	7,890	233,142
Rice	757	30,656	1,049	41,625
Moss	83	3,309	44	1,752
Pecans	10	1,580	3	1,332
Hides	14	2,359	25	3,959
Cotton and cotton seed	8,992	301,892	3,360	101,145
Cotton-seed oil	149	6,100	159	7,080
Wood	4,406	4,463	2,985	4,331
Miscellaneous	9,253	36,023	2,149	19,598
Total	67,144	3,191,943	62,402	3,841,488
RECEIPTS.				
Machinery, merchandise, coal, saw logs, etc	171,639	2,061,124	223,689	1,410,102
Grand total	238,783	5,253,067	286,091	5,251,590

Comparative statement of receipts and shipments for eight years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1892	64,866	$833,110	1896	298,685	$4,269,695
1893	115,080	5,754,542	1897	303,029	4,103,724
1894	383,154	7,378,789	1898	238,783	5,253,067
1895	279,928	5,794,483	1899	286,091	5,251,590

Increase of 1899 over 1898, 47,308 tons.

U 10.

IMPROVEMENT OF CHANNEL, BAY, AND PASSES OF BAYOU VERMILION, LOUISIANA.

No work was done on this stream during the past fiscal year. For history of the work, details of improvement, and results obtained, see Appendix R, pages 1505 and 1506, Annual Report of the Chief of Engineers for 1896.

The river and harbor act of March 3, 1899, appropriated $2,500 for continuing the improvement of this bayou. With the funds available it is proposed to clear the stream of snags and overhanging trees from Abbeville, La., to the Southern Pacific Railroad Bridge, a distance of about 16 miles. A subproject to this effect was approved May 18, 1899. Specifications covering the work have been prepared, and proposals will shortly be invited.

Money statement.

July 1, 1898, balance unexpended	$1,057.55
Amount appropriated by river and harbor act approved March 3, 1899	2,500.00
	3,557.55
June 30, 1899, amount expended during fiscal year	36.77
July 1, 1899, balance unexpended	3,520.78
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	9,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving channel, bay, and passes of Bayou Vermilion, Louisiana.

By act of Congress—

Approved July 13, 1892	$7,500
Passed August 18, 1894	5,000
Passed June 3, 1896	1,000
Approved March 3, 1899	2,500
Total	16,000

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers		3
Trips		206
Net registered tonnage (206 trips)	tons..	7,074
Schooners		2
Trips		24
Net registered tonnage (24 trips)	tons..	252
Barges		11
Trips		410
Tonnage (410 trips)	tons..	37,560
Total vessels		16
Total trips		640
Total tonnage (640 trips)	tons..	44,886

Draft of heaviest vessel: Light, 2 feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
Lumber	315	$1,680	200	$1,200
Rice	297	12,039	8,310	33,334
Cotton	1,084	121,436	632	75,930
Cotton seed	1,556	12,528	822	6,568
Wood	1,600	a 2,400	800	1,200
Cattle	237	12,130	140	7,140
Sugar	1,518	108,438	1,678	131,171
Merchandise	894	40,759	1,301	55,481
Molasses	165	385	186	3,915
Coal	1,196	7,820	900	4,400
Total	8,862	314,615	14,969	320,339

a This amount was given in previous report as $21,160, through error.

Comparative statement of receipts and shipments for six years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1894	43,822	$923,777	1897	6,126	$282,892
1895	12,993	429,172	1898	8,862	314,615
1896	13,022	355,186	1899	14,969	320,339

Increase of 1899 over 1898, 5,724 tons.

U 11.

IMPROVEMENT OF MERMENTAU RIVER AND TRIBUTARIES, LOUISIANA.

The first work done on this improvement was in 1892, and carried on from the lower end of Lake Arthur up the Mermentau River for 38 miles. For detailed information of the progress of this work see pages 1507-1508, Annual Report of the Chief of Engineers for 1896.

The project approved June 15, 1897, provided for dredging and the construction of brush dams to secure a channel 50 feet wide and 6 feet deep. Under contract operations under this project were carried on from December 24, 1897, to April 14, 1898, two dams being completed, and the bars being dredged to an average depth of 8 feet, with a width of 50 feet. See page 1478, Annual Report of the Chief of Engineers for 1898.

The act of March 3, 1899, appropriated $6,115.25 for completing this improvement, and a subproject was forwarded to the Chief of Engineers on June 27, 1899.

From a recent examination it was found that the brush dams were in good condition, but the channel has shoaled in places, requiring redredging. If the dredged material is placed on shore, it is believed the channel will maintain itself. After the completion of the projected work it is estimated that $2,500 will be required annually for its maintenance.

Money statement.

July 1, 1898, balance unexpended	$919.24
Amount appropriated by river and harbor act approved March 3, 1899	6,115.25
	7,034.49
June 30, 1899, amount expended during fiscal year	25.82
July 1, 1899, balance unexpended	7,008.67
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Abstract of appropriations for improving Mermentau River and tributaries, Louisiana

By act of Congress—	
Approved July 13, 1892	$7,500.00
Passed August 18, 1894	5,000.00
Passed June 3, 1896	5,000.00
Approved March 3, 1899	6,115.25
Total	23,615.25

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	11
Trips	453
Net registered tonnage (453 trips) tons	12,395
Schooners	6
Trips	66
Net registered tonnage (66 trips) tons	1,278
Barges	12
Trips	230
Tonnage (230 trips) tons	11,500
Total vessels	29
Total trips	749
Total tonnage (749 trips) tons	25,173

Draft of heaviest vessel: Light, 3 feet; loaded, 5 feet 7 inches.

Receipts and shipments for two years.

Articles.	Year ending May 31— 1898. Tons.	1898. Value.	1899. Tons.	1899. Value.
Cotton and cotton seed	2,134	$23,048	550	$6,000
Rice	5,699	240,650	7,974	323,742
Lumber	3,920	14,020	5,270	25,320
Wood	4,500	8,300	4,300	7,975
Merchandise	2,397	64,852	1,622	57,013
Coal			2,520	9,450
Total	18,650	350,870	22,236	429,500

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	16,250	$324,900	1897	12,210	$278,286
1894	5,437	188,950	1898	18,650	350,870
1895	15,955	300,163	1899	22,236	429,500
1896	16,459	206,777			

Increase of 1899 over 1898, 3,586 tons, representing a value of $78,630.

U 12.

IMPROVEMENT OF MOUTH AND PASSES OF CALCASIEU RIVER, LOUISIANA.

The original project under which the present work is being conducted was approved August 13, 1892, and work under it has been continued at intervals since then, the jetty work being done under contract and the dredging with the Government dredge and hired labor. For details of the progress of the work see Annual Report of the Chief of Engineers for 1897, page 1769.

A contract was entered into on April 6, 1898, with Charles Clarke & Co., of Galveston, Tex., for dredging the channel in Calcasieu Pass. Work was carried on from May 26, 1898, to December 31, 1898. A distance of 8,063 feet was dredged, restoring the channel 50 feet wide and 8 feet deep, and connecting deep water in Calcasieu Lake and Pass.

Act of March 3, 1899, appropriated $35,000 for continuing the improvement, and a project covering the work will shortly be submitted.

It is estimated that $10,000 will be required annually for maintenance of the channel and jetties.

It is estimated that $220,000 can be profitably expended for improvement during the fiscal year ending June 30, 1901, as follows:

Calcasieu Pass: For completion of east jetty, 1,500 feet:		
Mattress, 14,166⅔ square yards, at 70 cents	$9,916.67	
Riprap stone, 25,464 tons, at $2	50,928.00	
Granite block, 1,000 tons, at $4	4,000.00	
		64,844.67
Completion of west jetty, 4,000 feet:		
Mattress, 37,777.78 square yards, at 70 cents	26,444.44	
Riprap stone, 59,022.11 tons, at $2	118,044.22	
Granite block, 2,666.67 tons, at $4	10,666.67	
		155,155.33
Total		220,000.00

Money statement.

July 1, 1898, balance unexpended		$13,023.43
Amount appropriated by river and harbor act approved March 3, 1899		35,000.00
		48,023.43
June 30, 1899, amount expended during fiscal year		10,183.73
July 1, 1899, balance unexpended		37,839.70
Amount (estimated) required for completion of existing project		220,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$220,000.00	
For maintenance of improvement	10,000.00	
		230,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving mouth and passes of Calcasieu River, Louisiana.

By act of Congress—	
Approved June 10, 1872	$15,000
Approved March 3, 1881	15,000
Passed August 2, 1882	10,000
Approved July 5, 1884	6,500
Of August 11, 1888	10,000
Approved September 19, 1890	75,000
Approved July 13, 1892	100,000
Passed August 18, 1894	90,000
Passed June 3, 1896	80,000
Approved March 3, 1899	35,000
Total	436,500

COMMERCIAL STATISTICS.

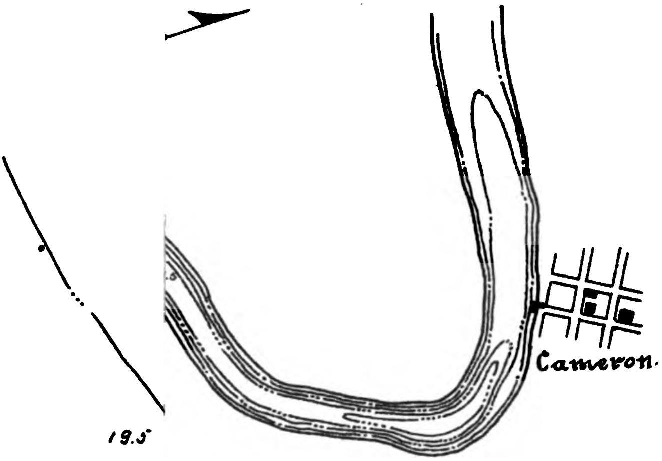
[From June 1, 1898, to May 31, 1899.]

Steamers		10
Trips		453
Net registered tonnage (453 trips)	tons	15,239
Schooners		28
Trips		182
Net registered tonnage (182 trips)	tons	4,394
Barges		10
Trips		180
Tonnage (180 trips)	tons	9,944
Total vessels		48
Total trips		815
Total tonnage (815 trips)	tons	29,577

Draft of heaviest vessel: Light, 2½ feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
Lumber	171,636	$499,510	154,132	$383,063
Cotton	1,039	21,480	584	6,480
Rice	584	23,679	1,790	67,728
Merchandise	16,758	200,452	18,145	159,771
Total	190,017	745,071	174,651	617,042



Improving

casieu River & Pass, La.

Calcasieu Pass.

Surveyed June 1st. to 16th. 1892

Under the direction of

mes B. Quinn, Corps of Engineers, U.S. Army

by

J. L. Brownlee, Asst. Engineer.

To accompany

Scale of Feet.

0 2000' 4000'

Guggenheimer, Weil & Co. Photo.-Litho. Baltimore.

Eng 56 1

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	207,545	$2,141,750	1897	141,029	$664,870
1894	344,973	1,600,574	1898	190,017	745,071
1895	254,394	788,274	1899	174,651	617,042
1896	202,775	691,542			

U 13.

IMPROVEMENT OF JOHNSONS BAYOU, LOUISIANA.

A preliminary survey of this bayou was made in January, 1897, in connection with a survey of Sabine Lake. It had a minimum depth of 12 feet, and a depth of 2½ feet over the bar at its mouth, where it empties into Sabine Lake.

An appropriation of $2,500 was made by act of March 3, 1899, for the improvement, and under this appropriation a project was approved on April 10, 1899. The project provides for dredging the channel at the mouth 6 feet deep, and of such width as funds would permit, from the 6-foot depth in Sabine Lake to a 6-foot depth in the bayou.

Specifications covering the work will shortly be submitted.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$2,500.00
July 1, 1899, balance unexpended	2,500.00

Abstract of appropriations for improving Johnsons Bayou, Louisiana.

By act of Congress approved March 3, 1899	$2,500

U 14.

REMOVING WATER HYACINTHS FROM LOUISIANA WATERS.

The river and harbor act of March 3, 1899, appropriated $25,000 for the construction of a boat suitable for operating on the navigable streams of Louisiana and removing the aquatic plant known as the water hyacinth; $1,000 for log booms, to be used as adjuncts to such steamer; and $10,000 for conducting the necessary operations, making $36,000 in all, according to the estimate and recommendation of the War Department, as found in House Doc. No. 91, Fifty-fifth Congress, third session.

Under the provisions of this act, the project approved on May 9, 1899, provides for the expenditure of $25,000 for the purchase or construction of a boat and machinery suitable for raising the plants and crushing them, $1,000 for constructing log booms across the mouths of small streams to prevent the drift of the hyacinths into the larger rivers and bayous, and $10,000 for conducting the operations.

Under this project, proposals are being invited for furnishing a sternwheel boat of suitable dimensions. These proposals will be opened July 21, 1899.

Experiments will be conducted with a view to determining the most suitable machinery for raising and crushing the plants.

It is estimated that $20,000 will be required annually to keep the navigable streams of Louisiana free from the water hyacinths.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$36,000.00
July 1, 1899, balance unexpended	36,000.00
July 1, 1899, outstanding liabilities	14.53
July 1, 1899, balance available	35,985.47
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	20,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Abstract of appropriations for constructing boat and log boom and conducting operations for removing water hyacinths from streams of Louisiana.

By act of Congress approved March 3, 1899	$36,000

U 15.

IMPROVEMENT OF MOUTHS OF SABINE AND NECHES RIVERS, TEXAS.

In 1895 the Sabine River bar, at its mouth, was dredged out by the Government dredge, and a cut was partially made across the bar at the mouth of the Neches River, both of which streams are tributary to Sabine Lake.

During a survey of Sabine Lake in 1897 it was found that the cut made through the Sabine River bar was in good condition, and that there was but 5 feet of water over the Neches bar. During a more recent examination it was found that the channel at the mouth of Sabine River was 7 feet deep and at the mouth of the Neches River 4 feet, but the part that had been dredged was in good condition.

The act of March 3, 1899, appropriated $10,000 for improving the mouths of these streams, the expense of a reexamination of the proposed channel through Sabine Lake to be paid out of same.

The Board of Engineers constituted under the provisions of this act held meetings at New Orleans and Sabine Lake on April 20 and 21, 1899, respectively, and after considering the questions at hand adjourned, pending the procurement of further information.

A project covering the improvement indicated above will shortly be submitted for consideration.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$10,000.00
June 30, 1899, amount expended during fiscal year	113.01
July 1, 1899, balance unexpended	9,886.99

Abstract of appropriations for improving mouths of Sabine and Neches rivers, Texas.

By act of Congress approved March 3, 1899	$10,000

U 16.

IMPROVEMENT OF SABINE RIVER, TEXAS.

No work was done on this stream during the past fiscal year. For details of the improvement see pages 1515 to 1517, Annual Report of the Chief of Engineers for 1896.

Under subproject approved June 9, 1897, it was contemplated to clear the river of obstructions from Morgans Bluff to the head of the Narrows. Proposals for doing the work were invited in August, 1897, but none were received, as the amount available was too small to warrant the equipment of a boat.

The river and harbor act of March 3, 1899, appropriated $2,000 for maintenance. A subproject covering the removal of obstructions from Morgans Bluff to Sudduths Bluff was submitted on June 27, 1899. It is expected that this work will shortly commence.

It is estimated that $2,000 annually will be required for maintenance of the improvement.

Money statement.

July 1, 1898, balance unexpended	$2,007.57
Amount appropriated by river and harbor act approved March 3, 1899	2,000.00
	4,007.57
June 30, 1899, amount expended during fiscal year	106.78
July 1, 1899, balance unexpended	3,900.79
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Abstract of appropriations for improving Sabine River, Texas.

Allotted from act approved June 10, 1872	$2,700
By act of Congress—	
Approved June 18, 1878	10,000
Approved March 3, 1879	6,000
Approved June 14, 1880	5,000
Approved March 3, 1881	7,000
Passed August 2, 1882	4,000
Approved July 13, 1892	5,000
Passed August 18, 1894	5,000
Passed June 3, 1896	2,000
Approved March 3, 1899	2,000
Total	48,700
Amount allotted from appropriation of $275,000 for improving Sabine Pass, Texas, by sundry civil act of March 2, 1895, and expended under this appropriation	4,000
Total	52,700

The above amount was allotted for dredging bar across the mouth of Sabine River from the appropriation dated August 18, 1894, for improving Sabine Pass, Texas, and the work was done by the Government dredge and hired labor.

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Steamers	14
Trips	510
Net registered tonnage (510 trips) ... tons..	7,004
Schooners	13
Trips	47
Net registered tonnage (47 trips) ... tons..	1,715
Barges	23
Trips	189
Tonnage (189 trips) ... tons..	50,200
Total vessels	50
Total trips	746
Total tonnage (746 trips) ... tons..	58,919

Draft of heaviest vessel: Light, 2½ feet; loaded, 7 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
Lumber	263,825	$748,857	263,534	$717,048
Cotton	226	25,256	224	26,910
Staves	8,453	505,946	5,024	301,075
Merchandise	3,002	114,498	1,860	61,960
Total	275,506	1,394,557	270,642	1,106,993

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	146,863	$1,591,280	1897	245,364	$1,181,154
1894	245,657	1,518,630	1898	275,506	1,394,557
1895	182,738	736,044	1899	270,642	1,106,993
1896	271,257	979,380			

U 17.

IMPROVEMENT OF HARBOR AT SABINE PASS, TEXAS.

For a history and detailed progress of this work see the following reports of the Chief of Engineers: For 1896, pages 1512–1514; for 1897, page 1771; for 1898, page 1482.

By the river and harbor act of 1896 contracts were authorized to be entered into for the completion of the present project of improvement, the cost being limited to $1,050,000.

The sundry civil act of June 4, 1897, appropriated $350,000 for improvement under the continuous-contract system, $100,000 for the purchase of a dredge boat, and $30,000 for operating same during the fiscal year ending June 30, 1898.

The project approved December 8, 1896, calls for the construction of 5,300 linear feet, more or less, of the east jetty, and 6,600 linear feet, more or less, of the west jetty, at a cost of $985,000, and that $65,000 be expended in the enlargement and maintenance of the dredged channel.

The project for the expenditure of the $130,000 for purchasing and operating a dredge was approved June 29, 1897.

On May 10, 1897, contract was entered into with Messrs. Christie & Lowe, of Chicago, Ill., for extending the east and west jetties, and for dredging in the channel, which was approved June 22, 1897. The contractors commenced work on August 10, 1897, and the dredging was completed in October, 1897.

On June 30, 1897, the east jetty had a total length of 19,500 feet; on June 30, 1898, the length was 23,600 feet. During the past fiscal year this jetty was extended 1,200 feet, giving a total length of 24,800 feet, and completing the foundation. Of this, 19,500 feet is capped, 5,000 feet is in course of construction, and 300 feet, at the outer end, is foundation only.

On June 30, 1896, the west jetty was 14,875 feet long. During 1897 about 3,000 feet of this was capped, and during the past fiscal year the jetty was extended 3,700 feet, leaving 2,900 feet of foundation work to be completed. The total length of the west jetty is now 18,575 feet, of which 15,250 feet is capped, 600 feet has been brought up to mean low water, ready for capping, and 2,725 feet is in course of construction.

On October 18, 1897, proposals were opened for building the dredge boat authorized, but none of the proposals being in conformity with the specifications they were rejected. On April 6, 1899, proposals were again opened for the construction of this dredge, but all bids were in excess of the amount available. By direction of the Chief of Engineers correspondence has been entered into with shipbuilders with a view to building a dredge substantially as outlined in the specifications, but bringing the cost within the limit of the amount available.

Under act of March 17, 1898, making available for immediate use $15,000 of the $30,000 appropriated by act of June 4, 1897 (project approved March 28, 1898), dredging operations were carried on in the channel during July, 1898, resulting in the removal of 103,863 cubic yards of material. The remaining $15,000 appropriated by act of June 4, 1897, reverted to the Treasury on July 1, 1898.

The Chief of Engineers granted authority on December 29, 1898, to expend $30,000 for dredging, in lieu of jetty work, under the present continuous contract. Dredging operations were carried on from May 1 to June 27, 1899, 300,200 cubic yards of material being taken out and the channel being deepened from 24 to 25 feet.

Act of March 3, 1899, appropriated $150,000 for straightening, widening, and otherwise improving the main ship channel by removing such portions of the oyster flat as funds available will permit within a certain prescribed area. A project to this effect was approved on March 27, 1899, and proposals for doing the work were opened on June 15, 1899. The contract was awarded to Rittenhouse Moore Dredging Company, Mobile, Ala., at 0.095 cents per cubic yard. Contract will shortly be entered into.

The subproject approved July 29, 1898, provided for the expenditure of the $400,000 appropriated July 1, 1898, and subproject approved April 6, 1899, provided for the expenditure of the $264,000 appropriated by act of March 3, 1899. Both subprojects embraced jetty work, under continuous contract.

A severe storm, which occurred on the Gulf coast from June 26 to 28, 1899, destroyed two brush mats on the west jetty. These mats were sunk in 18 feet of water, with more than 1,000 tons of small stone on each, and, in addition to this, on one mat a piling was driven with 313 tons of block sandstone around it. The loss of these mats was probably caused by the current running across the east jetty, south of the granite capping, and being forced around the end of the west jetty, as this jetty is built up to surface farther out than the east jetty.

The amount of commerce involved in this improvement is $5,451,615.

Money statement.

July 1, 1898, balance unexpended		[1]$745, 102. 90
Amount appropriated by river and harbor act approved March 3, 1899.		150, 000. 00
Amount appropriated by sundry civil act approved March 3, 1899		264, 000. 00
		1, 159, 102. 90
June 30, 1899, amount expended during fiscal year		427, 906. 17
July 1, 1899, balance unexpended		731, 196. 73
July 1, 1899, outstanding liabilities	$44, 203. 81	
July 1, 1899, amount covered by uncompleted contracts	440, 944. 42	
		485, 148. 23
July 1, 1899, balance available		246, 048. 50
Amount (estimated) required for completion of existing project		36, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$36, 000. 00	
For maintenance of improvement	110, 000. 00	
		146, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

Abstract of appropriations for improving harbor at Sabine Pass, Tex.

From act approved August 30, 1852 (survey)	$5, 000. 00
Allotted from act approved June 10, 1873 (survey)	2, 000. 00
By act of Congress—	
Approved March 3, 1875	20, 000. 00
Approved August 14, 1876	38, 000. 00
Approved June 18, 1878 (allotted)	30, 000. 00
Approved March 3, 1879	25, 000. 00
Approved June 14, 1880	50, 000. 00
Approved March 3, 1881	150, 000. 00
Passed August 2, 1882	150, 000. 00
Approved July 5, 1884	200, 000. 00
Approved August 5, 1886	198, 750. 00
Of August 11, 1888	250, 000. 00
Approved September 19, 1890	300, 000. 00
Approved July 13, 1892	350, 000. 00
Of August 18, 1894	[2]271, 000. 00
Of June 3, 1896	75, 000. 00
Sundry civil act approved June 4, 1897	480, 000. 00
Sundry civil act approved July 1, 1898	400, 000. 00
Sundry civil act approved March 3, 1899	264, 000. 00
Approved March 3, 1899	150, 000. 00
	3, 408, 750. 00
Reverted to Treasury from act of June 4, 1897	16, 297. 03
Total	3, 392, 452. 97

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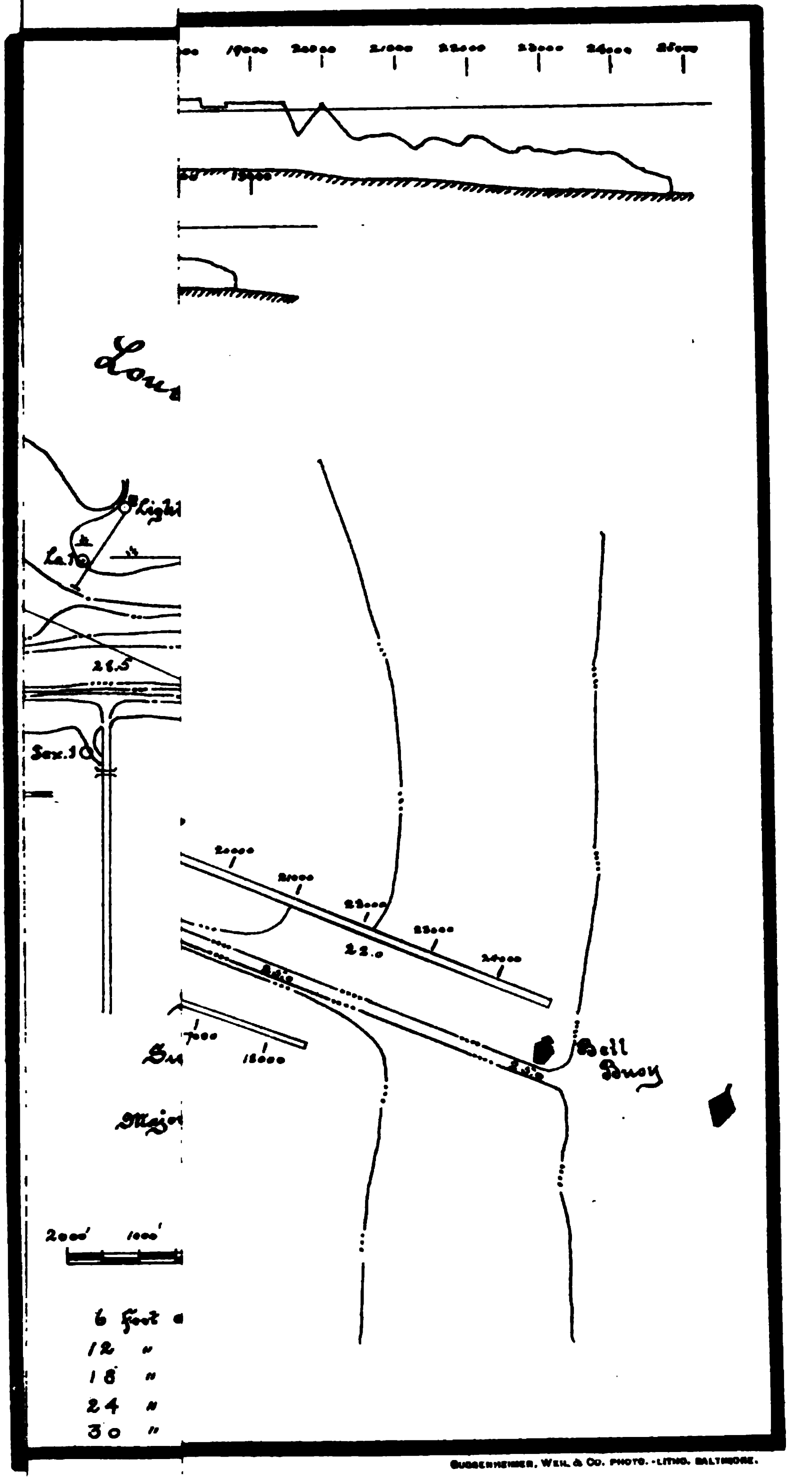
[1] Balance reported as unexpended on July 1, 1898, in last report, $761,399.93. Of this amount, $16,297.03 reverted to the Treasury from the appropriation made by sundry civil act of June 4, 1897, for operating dredge boat at Sabine Pass, Tex., for fiscal year 1898. The correct balance, therefore, July 1, 1898, should be $745,102.90.

[2] The total amount of this appropriation was originally $275,000, but of this sum $4,000 was allotted by sundry civil act of March 2, 1895, for dredging of a bar across the mouth of Sabine River, Texas, and was expended under that improvemet.



Guggenheimer, Weil & Co. Photo.-Litho. Baltimore.

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Abstract of proposals for building a dredge boat for improving harbor at Sabine Pass, Tex., opened April 6, 1899, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Amount of bid.	
		Wood hull.	Steel hull.
1	The Bucyrus Co., South Milwaukee, Wis	$105,800	$122,000
2	Iowa Iron Works, Ltd., Dubuque. Iowa	109,000	120,000
3	Mississippi Valley Construction Co., St. Louis, Mo	....	119,700

All bids being in excess of $99,000, the amount available, they were rejected, and propositions invited from the builders looking to construction of a dredge on the lines of specifications within the limit.

Abstract of proposals for dredging for improving harbor at Sabine Pass, Tex., opened June 15, 1899, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Price bid per cubic yard.	Total bid on basis of 900,000 cubic yards.
1	National Dredging Co., Wilmington, Del	$0.12	$108,000
2	Rittenhouse Moore Dredging Co., Mobile, Ala	.095	*a* 85,500
3	Chas. Clarke & Co., Galveston, Tex	.15	135,000
4	Atlantic, Gulf and Pacific Co., N. Y	.118	*b* 106,200

a Informal and irregular; proposal and guaranties not made on forms provided. *b* Lowest formal bid.

Contract authorized to be awarded to Rittenhouse Moore Dredging Company, July 6, 1899.

CONTRACTS NOW IN FORCE FOR IMPROVING HARBOR AT SABINE PASS, TEX.

For extension of jetties and for dredging under the continuing contract system. Name of contractors, Christie & Lowe, Chicago Ill.; date of approval, June 22, 1897. Work was commenced on August 10, 1897; dredging part of contract was completed in October, 1897; dredging in lieu of jetty work commenced May 1 and completed June 27, 1899. The entire work under contract to be completed on or before May 31, 1901.

COMMERCIAL STATISTICS.

[From June 1, 1898, to May 31, 1899.]

Vessels	89
Trips	1,253
Net registered tonnage (1,253 trips) ....tons..	260,936

Draft of heaviest vessel, 22½ feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1898.		1899.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber	144,491	$686,161	85,877	$429,380
Merchandise	3,415	165,430	12,489	1,092,910
Cotton and cotton-seed products	4,054	353,317	6,025	563,052
Wheat and corn in bulk	11,121	328,000	8,034	204,850
Flour and meal	9,628	390,526	1,998	207,708
Meat and lard	1,131	124,950	701	50,026
Total	173,840	2,000,384	115,124	2,547,926
RECEIPTS.				
Rock	58,800	111,146	171,023	306,004
Coal	3,346	13,384	6,806	30,627
Merchandise	7,414	238,628	34,029	2,567,058
Grand total	238,400	2,363,542	326,982	5,451,615

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	15,060	$189,950	1897	87,632	$475,288
1894	40,966	280,189	1898	238,400	2,363,542
1895	47,691	252,823	1899	326,962	5,451,615
1896	48,886	199,042			

Increase of 1899 over 1898, 88,582 tons, representing a value of $3,088,073.

REPORT ON ENLARGEMENT OF MAIN SHIP CHANNEL AT SABINE PASS, TEX.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., January 7, 1899.

GENERAL: I have the honor to report as follows upon the proposition to enlarge, etc., the main ship channel at Sabine Pass, Tex., as required in letter from your office dated January 5, 1899.

The channel opposite the wharves at Sabine Pass is rather narrow, and in order to afford room for the safe maneuvering of ships will have to be widened. From such information as I have at hand I am of the opinion that the area indicated upon the blue print by light-pink colored lines would about meet the requirements, if the material included was excavated so as to give a depth of 27 feet at mean low water. The improvement is desirable, and could be done for $150,000, including contingencies.

Very respectfully, your obedient servant,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

U 18.

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI.

The river and harbor act of March 3, 1899, appropriated $16,000 for improving this stream. The project approved April 18, 1899, provides for dredging to remove the numerous obstructions in the river from the mouth to the Yazoo and Mississippi Valley Railroad, a distance of about 60 miles, to give navigation for boats drawing 6 feet of water.

A preliminary examination in 1896 showed that this river had a depth of from 8 to 20 feet, except over the bars, where there was from 2½ to 3 feet, and a width of 150 to 300 feet. There has been no navigation on it, on account of the numerous obstructions, but it flows through a fertile and populous country, and its improvement will open up a large commerce.

Proposals for improving this river were opened on June 22, 1899, but were rejected on account of certain discrepancies between the bids. Revised specifications are being prepared, and proposals will be again invited in a short time.

After the completion of the proposed improvement it is estimated that $2,500 will be required annually for maintenance.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$16,000.00
July 1, 1899, balance unexpended	16,000.00
July 1, 1899, outstanding liabilities	2.03
July 1, 1899, balance available	15,997.97
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

Abstract of appropriations for improving Homochitto River, Mississippi.

By act of Congress—	
Approved March 3, 1899	$16,000

Abstract of proposals for hire of boat for improving Homochitto River, Mississippi, opened by Maj. James B. Quinn, Corps of Engineers, June 22, 1899.

No.	Name and address of bidder.	Price bid per day of 8 hours.	Total bid, basis of 200 days.
1	J. H. Gardner, New Orleans, La	$122.00	$24,400
2	Victor von Schoeler, Bay St. Louis, Miss	61.50	12,300
3	John K. Burriss, New Orleans, La	57.25	11,450
4	Louis Lafferanderie, New Orleans, La	59.00	11,800
5	Joseph Edward Crusel, New Orleans, La	47.50	9,500

All bids rejected on account of discrepancies in size of crews furnished. New bids will be invited.

U 19.

SURVEY RELATIVE TO THE PRACTICABILITY OF SECURING A NAVIGABLE CHANNEL OF ADEQUATE WIDTH AND OF 35 FEET DEPTH AT MEAN LOW WATER OF THE GULF OF MEXICO THROUGHOUT SOUTHWEST PASS, MISSISSIPPI RIVER.

[Printed in House Doc. No. 142, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 12, 1899.

SIR: Congress, by joint resolution approved February 17, 1898, provides for a survey of Southwest Pass of the Mississippi River and report upon the practicability of securing a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico; said survey to be made under the direction of the Secretary of War by a Board composed of three officers of the Corps of Engineers of the United States Army designated by him.

The Board contemplated by the resolution for the purpose of making this survey and report was constituted by orders from this office dated March 7, 1898, the Secretary having selected as its members Col. Henry

M. Robert, Maj. James B. Quinn, and Maj. Dan C. Kingman, of the Corps of Engineers.

The Board at once entered upon its duties with vigor. The work was commenced March 24, 1898, and the entire survey, both field and office work, was completed early in October.

The subject in hand has received that full and exhaustive consideration which its importance demands, and I have now the honor to submit the accompanying copy of the Board's report of January 7, 1899, with maps,[1] from which it will be seen that in the opinion of the Board the project presented will, if executed with vigor, secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass of the Mississippi River at a cost which is not excessive, considering the vast commercial interests involved.

The Board proposes the construction of parallel jetties from near East Point, on the left bank of the pass, and Stake Island, on the right bank, outward in prolongation of the channel to and beyond the crest of the bar; and, in addition to these, certain auxiliary works are provided for, including the construction of two dredges. The entire work proposed will, it is estimated, cost $13,000,000.

The Board calls attention to the necessity of providing for the maintenance, care, and repair of the works after construction, and estimates that the annual expense for this purpose will be about 2 per cent of the first cost of the work; also that a fund equal to 1 per cent per annum of the first cost of the work will abundantly provide for all future extension of the jetties rendered necessary by the re-formation of the outer bar.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. R. A. ALGER, *Secretary of War.*

REPORT OF BOARD OF ENGINEERS.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., January 7, 1899.

GENERAL: The Board of Engineers constituted by Special Orders, No. 9, Headquarters, Corps of Engineers, United States Army, Washington, D. C., March 7, 1898, has the honor to submit the following report:

The duties of the Board are set forth in the following joint resolution of Congress:

[PUBLIC RESOLUTION—No. 8.]

JOINT RESOLUTION providing for a survey and report upon the practicability of securing a navigable channel of adequate width and of thirty-five feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass of the Mississippi River.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the sum of ten thousand dollars, or so much thereof as may be necessary, be, and is hereby, authorized to be expended out of the unexpended balance of the two hundred and fifty thousand dollars appropriated by an Act entitled "An Act to provide for closing the crevasse in Pass a Loutre, one of the outlets of the Mississippi River, approved February twenty-sixth, eighteen hundred and ninety-seven," for the purpose of making a survey and report upon the practicability of securing a navigable channel of adequate width and of thirty-five feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass of the Mississippi River; said survey to be made, under the direction of the Secretary of War, by a board composed of three engineer officers of the United States Army, appointed by him.

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[1] Not reprinted. Printed in House Doc. No. 142, Fifty-fifth Congress, third session.

Approved, February 17, 1898.

Immediately after the appointment of the Board arrangements were made for making the required survey. Through the courtesy of the Mississippi River Commission there was secured for making the survey the services of Asst. Engineer J. A. Ockerson, now a member of the Mississippi River Commission, and a well-equipped survey party, with the steamer *Patrol*, and the necessary plant.

The field work was commenced March 24, 1898, and the entire survey, both field and office work, was completed early in October.

The Board met at New Orleans November 27, 1898, and proceeded at once to the Delta of the Mississippi River.

After two days spent in examining the Southwest Pass, the Pass a Loutre, and the South Pass, the Board returned to New Orleans, and on November 30, 1898, held a public meeting, at which all persons interested in the proposed improvement were permitted to be heard. The minutes of this meeting are transmitted herewith.

The Board continued in session at New Orleans until December 3, 1898, when, having agreed upon the substance of its report, it adjourned to meet again at New Orleans at the call of the senior member, after the necessary computations and estimates had been prepared.

On January 5, 1899, the Board reassembled at New Orleans and continued in session until January 7, 1899, when, having completed its report, it adjourned sine die.

The Board is required to make a survey and report upon the practicability of securing a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass of the Mississippi River.

THE SURVEY.

A complete survey was made, beginning at Pilots Station, in the main river above Head of Passes, and extending down Southwest Pass to deep water in the Gulf, a distance of about 23 miles, including also a sufficient portion of South Pass and of Pass a Loutre to show the relations of the several passes. In addition to this soundings were taken along the bar at the mouth of Southwest Pass over a crescent-shaped area about 9 miles long. As a whole the survey comprised a system of triangulation, a line of precise levels, location of bank lines, and hydrography.

The Southwest Pass of the Mississippi River is fully described in the survey and the accompanying report. Its total length, from its head to the crest of the bar beyond its mouth, is 19 miles. From its head downward for a distance of 2 miles the average distance between the banks is 1,890 feet; then for 7 miles more it has an average width of 1,360 feet, and beginning with the ninth mile from the head of the pass it gradually widens out until it attains a width of 4,300 feet at the East Point, the lowest land on its eastern bank, 15 miles from the head. Throughout the narrow portion of the pass the depth is all and more than is desired, the maximum in each section being about 75 feet. As the pass widens the depth becomes less. At Customhouse Bayou, about 11 miles below the head of the pass, the width is about 2,400 feet, and the 35 foot channel is more than 900 feet wide. This is an ideal section, and if this condition can be extended outward to the crest of the bar the problem will be completely and most satisfactorily solved.

The survey shows that on an average 41.4 per cent of the water discharged from the Mississippi River below Cubitts Gap goes through Southwest Pass. At times the discharge of the Southwest Pass is as low as 30 per cent below the average, while its extreme discharge exceeds the mean by 16 per cent.

The crest of the bar has advanced, in the sixty years between 1838 and 1898, some 15,540 feet, but the distance across the bar, measured between the 35-foot contours, has not increased during that period. The average annual advance of the bar, for these sixty years, has been 259 feet.

PRACTICABILITY OF OBTAINING A 35-FOOT CHANNEL OF NAVIGABLE WIDTH.

The cost of the work must always be an important consideration in determining the practicability of any engineering project. A disproportionate and excessive cost may be as effectual a bar as a natural obstacle that can not be overcome. The Board, therefore, considers that an approximate estimate of the probable cost of the improvement is required, in order to determine its practicability. To make this estimate it is necessary to decide upon a project which, if carried out, will produce the required result.

The following project, if executed with vigor, will, in the opinion of the Board, secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass of the Mississippi River at a cost which is not excessive, considering the vast commercial interests involved, and therefore, in the opinion of the Board, the proposed improvement is practicable.

The Board proposes the construction of parallel jetties from near East Point, on the left bank of the pass, and Stake Island, on the right bank, outward in the prolongation of the channel to and beyond the crest of the bar; these jetties to be placed at a distance of 2,400 feet apart from center to center. From these two designated land points the jetties must be prolonged inward, or equivalent works constructed to contract the channel to a corresponding width up to the point where this becomes the natural width of the pass.

In addition to these works, the natural banks of the pass must be raised and strengthened by the construction of levees from the inner end of the interior jetties to the head of the pass, and these levees must be farther extended upward upon both banks of the river for a distance of at least 2 or 3 miles. In connection with these levees all of the outlet bayous along the pass must be completely and permanently closed, and to prevent any enlargement of the Pass a Loutre, whereby the discharge in Southwest Pass would be diminished, a sill must be constructed across its head of sufficient size and strength to permanently hold its section.

In the case of the sea jetties, they are to start, as already explained, from near Stake Island, on the west bank, and near East Point, on the east bank, and extend over the crest of the bar and terminate in about 30 feet of water just beyond it. These jetties are to consist of riprap stone placed upon a heavy foundation mattress, and are to be covered and protected on the sea side by large stone of sufficient weight to resist, without motion, the action of the waves. The foundation mattress should be constructed of willows built up in layers alternately lengthwise and crosswise of the mat, held together and compressed by a suitable device (preferably of wood), and the upper surface of the mattress should be covered with pockets to prevent loss of the stone. The mats, when completed, should have a thickness of compressed willows of not less than 3 feet, and, when sunk, should be covered with riprap stone to a depth of not less than 2 feet. The mattress throughout the length of the jetties should have a width of not less than 150 feet, and the axis of the jetty should be along the center line of the mat.

The individual mats should be made as large as they can be conveniently and safely handled, and they should be sunk far in advance of the jetty construction. No part of the jetty proper should be constructed within 2,000 feet of the outer end of the mattress foundation until the entire foundation has been completed. To prevent the current from undermining the mattress and finally the jetty itself, additional mattresses 150 feet square should be placed along the channel side at intervals of 300 feet apart in the clear. These mattresses should be constructed, loaded, and sunk in precisely the same manner as the foundation mat is prepared. The effect of these being, in case the current tends to approach the jetty, that they will first be undercut at their outer ends, and will bend downward in such a way as to form spurs, which will protect the main structure from undermining and injury.

The jetty is to be constructed of riprap of size convenient for handling, and is to be so built up that after all settlement has taken place it will have side slopes of 2 on 3, and a thickness of 30 feet at the level of mean low water of the Gulf. It is then to be rounded over on the top so that its crest will be 4 feet above this level. The part above water and the exterior slopes down to the maximum depth at which wave action can be felt is to be formed of large blocks of stone roughly laid in the form of a pavement, so as to best resist the force of the waves. The same heavy stone is also to be used upon the channel side of the jetties at their outer ends, and carried as far up the channel as the wave action would have sufficient violence to be injurious. A very liberal allowance must necessarily be made for the compression of the mattress, consolidation of the stone, and the sinking or settlement of the entire structure into the bottom.

At the outer end of the east jetty provision must be made for the erection and maintenance of a light-house. For the purpose of estimate, it is assumed that the jetty structure is curved around outward so as to inclose an area of sufficient size for light-house purposes. About 400 feet of length of jetty is assumed as necessary. About one-half of this amount would be required for the protection and strengthening of the outer end of the west jetty.

From the land end of the sea jetties other jetties of lighter construction and different design should be extended up the pass, so as to maintain the width of 2,400 feet until this width is found naturally in the pass. The Board thinks it sufficient to construct these interior jetties of some form of tight sheet piling, made of creosoted lumber and braced and strengthened by ordinary piling, so as to form a work analogous to that used in the closure of Pass a Loutre crevasse. Against this structure, upon either side, dredged material may be deposited until it has been completely covered. The only object of this work is to secure the proper contraction of the channel. For a portion of the distance, where no outlet bayous interfere, this might, perhaps, be better effected by spur dikes properly spaced, and there would be no objection to using them. From the inner end of these interior jetties levees of good profile should be constructed near the river bank. For the purpose of estimate these are assumed to be 6 feet high, to have a crown width of 9 feet, and side slopes of 1 on 3. All of the outlet bayous which can not be conveniently closed by the levees must be closed by a sheet-piling structure similar to that used in the interior jetty.

The sill at Pass a Loutre should be not less than 200 feet wide, and should be constructed of a mattress similar to that used for the foundation of the sea jetties, except that the stone covering might be 1 foot in thickness instead of 2 feet. It should be extended from bank to bank, and would be about 3,600 feet in length.

The Board does not think it desirable that these works should be required or expected of themselves to secure and maintain the desired depth of water through all the portions of the pass where it is now less than 35 feet deep. On the contrary, it relies greatly upon the use of powerful dredges, to assist in the removal of the material and to so guide and direct the current in its action that the channel finally obtained shall be approximately straight, and midway between the jetties and cross the bar at right angles to its crest.

It will be necessary also to remove a sufficient portion of the old sill constructed across the head of the Southwest Pass, provided this sill is still found to exist, and some considerable dredging will be necessary to establish a proper channel from the head of the pass upward into the main body of the river.

The Board is further of the opinion that it will be advantageous to so execute this dredging as to reduce as much as possible the contraction of the waterway resulting from the jetties while in the course of construction, and in this manner reduce to a minimum the shoaling in the pass itself which may result from the unavoidable disturbance of its regimen by the temporary interference with the flow of the water through it.

The Board recognizes the difficulties which will have to be encountered in the construction of all these works. Stone will necessarily enter very extensively into the construction of the jetties, and none is to be obtained except by transporting it from a great distance.

The exposure to storms will render the work very expensive, and the uncertain character of the bottom upon which the jetties are to be built makes it difficult to determine the quantity and extent of the settlement which will undoubtedly take place. The experience gained in the prosecution of the work will certainly develop methods both economical and advantageous. The Board, therefore, feels that it should not undertake to fix absolutely the kind and the extent of the work to be done, but that the best interests of the Government will be served by leaving to the Secretary of War such discretion as will enable him to adopt and use the best methods and materials as they are discovered and developed in the prosecution of the work. The plans described, therefore, are such as have been selected for the purpose of estimate, and should not necessarily be strictly adhered to unless experience shall fully justify them.

It is desirable that at least two powerful dredges be constructed at the beginning of the work, for use in forming and maintaining the required channel.

Estimates.

Sea jetties	$7,700,000
East jetty head	108,000
West jetty head	54,000
Inside jetties	1,840,000
Levees	200,000
Outlet bayous	60,000
Sill at Pass a Loutre	166,000
Dredging at and beyond lower end of pass 300 feet wide to full depth	332,000
Dredging at head of pass 600 feet wide to full depth	56,000
Two dredges	300,000
Other plant, barges, wharves, etc	200,000
	11,016,000
Add for contingencies (about 18 per cent)	1,984,000
In round numbers	13,000,000

In addition to the foregoing it will be necessary to provide for the maintenance of these works after they have once been constructed. Works of this kind, exposed to almost every destructive agency which nature develops, can not be left uncared for. Annual dredging will be necessary to maintain the fixity of the channel, and certain repair work will have to be done to the jetties to compensate for settlement and to repair the injuries resulting from storms. The levees will have to be maintained and perhaps extended, and the plant itself, necessary and proper to this work, must also be cared for and from time to time renewed. It is estimated that about 2 per cent of the first cost of this work will be necessary each year for its care and maintenance.

It would be too much to hope that these works, once completed and properly maintained, would forever, of themselves, secure a deep entrance into the Mississippi River. In pushing forward the jetties at once to the crest of the bar, where it now is, we are simply anticipating the work of nature and doing at once what it would do imperfectly after many years of effort. The bar will be driven away, or rather it will be cut through, but in the course of nature it must again re-form.

We find its crest now about 4 miles from the end of the pass; but the end of the pass is broad and shoal, and numerous outlets impair the force and vigor of the current. When the end of the pass is made, artificially, a comparatively narrow and well-defined outlet, it is reasonable to assume that the crest of the bar must establish itself still farther away. It will re-form in time.

The Board is of the opinion, however, that a sinking fund equal to 1 per cent per annum of the first cost of the work would abundantly provide for all future extension of the jetties rendered necessary by the re-formation of the bar, and the Board is of the opinion that a great many years will elapse before any extension at all will be necessary The formation of the bar does not take place with anything like a rapidity commensurate to the quantity of material brought down by the pass, and its annual rate of advance will probably not be seriously augmented by the construction of the jetties. No apprehension need be felt that the extension of the pass by jetties, thus increasing its length at least 4 miles, will induce a flattening of the slope which will retard the velocity of the flow of the water, whereby its eroding and transporting power will be unduly diminished.

The velocity of the flow of the water in large rivers is dependent not only upon the slope of the water surface, but also upon the hydraulic mean depth of the channel. These two functions have equal weight in determining the velocity, and while, if either becomes zero, the velocity must also become zero, yet within limits we may increase one and proportionately diminish the other without affecting the velocity of the flow. The narrower and deeper channel afforded by the jetties will sufficiently increase the hydraulic radius to compensate for the diminished slope of the water surface, and the velocity of the current, and hence its eroding and transporting power, will not be injuriously affected.

All of the work proposed can be completed in five years, and the money should be so appropriated as to permit it to be done within this period. If the rate of progress is less, the quantity of work to be done will be increased, and hence the total cost will become proportionately greater.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.
JAMES B. QUINN,
Major, Corps of Engineers.
DAN C. KINGMAN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

LIST OF PAPERS ACCOMPANYING THIS REPORT.

A. Report of survey of Southwest Pass, by Assistant Engineer J. A. Ockerson.

B. Map of survey of Southwest Pass.

C. History of attempted improvements of the mouth of the Mississippi River, by Maj. James B. Quinn, Corps of Engineers.

D. Letter of Mr. M. J. Sanders, chairman executive committee, etc., on the economic value of a 35-foot channel from deep water in the Mississippi River to deep water in the Gulf of Mexico.

E. Memorandum of the 19 largest steamships trading with the port of New Orleans.

F. Minutes of public hearing held in New Orleans November 30, 1898.

G. Arguments in support of a petition to Congress for a 35-foot channel through the Southwest Pass.

A.

REPORT OF ASSISTANT ENGINEER J. A. OCKERSON ON SURVEY OF SOUTHWEST PASS, MISSISSIPPI RIVER, MARCH AND APRIL, 1898.

ST. LOUIS, MO., *October 1, 1898.*

MAJOR: I have the honor to submit the following report on the survey of Southwest Pass, Louisiana, which was made under my direction for the Board of Engineers appointed to make a survey and report upon a navigable channel throughout the pass.

In obedience to your instructions, I arrived at New Orleans on March 20, 1898, accompanied by Recorders E. D. Jones and J. W. Skelly.

The use of the steamer *Patrol* and plant, with a well-equipped survey party, had been tendered to the Southwest Pass Board by the Mississippi River Commission. This party completed its work and arrived at New Orleans on March 21. It was transferred to me for use in making the survey of Southwest Pass on the following day. Supplies and fuel were taken on board and the party left New Orleans for Head of Passes on the morning of March 23, arriving at Head of Passes Light at 6 p. m. of that day.

Work was actively begun on the following day. The launch *Gen. Rees*, with a crew of four men, belonging to the South Pass work, under Asst. Engineer C. Donovan, was turned over to me for use in the hydrographic work.

The survey party was organized as follows: J. A. Ockerson, assistant engineer, in charge of party; W. S. Williams, surveyor, precise levels; E. J. Thomas, surveyor, shore line and topography; T. C. Hockridge, hydrographer, assisted by Recorders E. D. Jones and E. S. Ela, locating soundings; William J. Cochran, recording on board the launch, and the launch crew; J. W. Skelly, platting. Besides these there were a steamboat crew of 9, 2 leadsmen, 4 rodmen, and 7 boatmen. The party numbered 33 persons all told.

The general scope of the work was to make a complete survey beginning at Pilots Station, in the main river, above the Head of Passes, and extending down Southwest Pass to depp water in the Gulf, a distance of about 23 miles; to include also a sufficient portion of South Pass and Pass a Loutre to show the relations of the several passes. In addition to this, soundings were taken along the bar at the mouth of Southwest Pass over a crescent-shaped area about 9 miles long.

As a whole, the survey comprised a system of triangulation, a line of precise levels, location of bank lines, and hydrography.

TRIANGULATION.

The system of triangulation began on the old Coast Survey line ◬ Doane— ◬ Bayou Grand, and closed on a base line near Southwest Pass Light-House. This base line was measured along the light-house walk with a steel tape. Three observation stations 15 feet high and four stations 30 feet high were erected. Angles were read at 18 stations with a 5-second theodolite. Readings were made whenever the stations were visible without waiting for good atmosphere. No attempt was made to attain a high degree of accuracy in this work, the object being merely to keep well within the requirements of this special survey and the scale on which it is platted.

In addition to the regular triangulation points there were also 12 precise-level bench marks set along west bank of the pass located trigonometrically from the triangulation stations.

A sketch of Southwest Pass, showing the triangulation scheme, is appended hereto (plate 1). The computation of triangle sides is appended, marked Table 1. The geographical positions of triangulation points, marked Table 2, are also appended.

DESCRIPTION OF TRIANGULATION STATIONS ESTABLISHED IN SURVEY OF SOUTHWEST PASS.

◬ Doane: This is the old Coast Survey point, the center being a screw pile. A tripod and platform 20 feet high was built over the point in March, 1898.

◬ Ockerson, 1898: This is on the left bank of Southwest Pass, about 75 feet from bank and 1,040 meters below Head of Passes Light-House. It is marked by a 30-foot station, and the center is marked by a tile buried 2 feet below the surface of ground. The tile is 4 by 18 by 18 inches, and the upper surface bears the inscription "Mississippi River Commission 1895." The surface mark is a 4-inch iron pipe resting on tile and projecting 2 feet above surface of ground. The cap on pipe is marked "Mississippi River Commission 1893." This station was established in April, 1898.

◬ Scott's Tower: This is on the right bank of Southwest Pass, about 105 meters above Scott's house. It is about 10 feet below upper angle in levee which surrounds the house and on the line running between the house and the pass. It is marked by a 30-foot station. The center is marked with a tile 4 by 18 by 18 inches, marked with the inscription "Mississippi River Commission 1895." This tile is buried 2 feet below the surface. The surface mark consists of a 4-inch iron pipe resting on the tile and projecting above ground about 2 feet. Cap of pipe is marked "Mississippi River Commission 1893."

◬ Willow: This is on left bank of Southwest Pass, about 825 meters above head of Double Bayou, about 25 meters from river bank to pipe. It is marked by a 30-foot station and a 4 by 18 by 18 inch tile with copper bolt in center. Tile is marked "Mississippi River Commission U. S. 1895." It is set about 36 inches below the surface. A 4-inch iron pipe is set over copper bolt, resting on tile. A cap on top of pipe is marked "Mississippi River Commission U. S. 1893." Station was established in April, 1898.

◬ Double Bayou: This is on the bay near end of land, on north bank of north branch of Double Bayou. It is on the main branch of the bayou. The station is marked with a 33-foot station built of yellow pine. The point is marked by a 4 by 4 inch scantling with a copper bolt set in top. The station is about 2 miles from right bank of pass. It was established in April, 1898.

◬ Pilot Town: This is on lookout tower at Pilot Tower, on left bank of bayou, about half way between river and gulf. The point used is in southwest angle of hatchway on top floor of tower. The tower is at west end of large building which fronts on the bayou.

△ C. P. 22: This is a 2 by 2 inch pole nailed to the gunwale of a wrecked barge lying on right bank on upper side of entrance to Light-house Bayou.

△ C. P. 25: This is a pole 2 by 2 inches set in ground on left bank opposite Southwest Pass light-house and near edge of Pass.

△ North Base: This is near the north end of walk running between the light-house and Light-house Bayou. The point is marked by a dot in center of head of a copper rivet driven into the third plank from the bayou side of the dock at the end of the walk. It is 1½ inches from the north edge of plank and 72 inches from the east end of plank. Rivet is in center of triangle, made with tacks. This point was established in April, 1898.

◬ Southwest Pass light-house: This is the top of column in center of structure around which the spiral stairway was built. This stairway and surrounding chamber was destroyed by fire in 1893, and the central column was also destroyed down to the main gallery at first landing. The top of post occupied for the station projects about 18 inches above the floor of first landing. It is practically in the center of the structure. This point was established in April, 1898.

△ East Point: This is on left bank of river at extreme south end of reeds about opposite Stake Island. It is marked by a station 15 feet high. The center is a nail in a vertical 4 by 4 inch yellow-pine post driven into the mud and braced. This point was established and station erected in April, 1898.

△ Southeast lump, 1898: This is on mud lump 95 meters from east end and 50 meters from south side on highest ground in east edge of grass. It is marked by a copper bolt in center of tile 4 by 18 by 18 inches. This tile is buried 20 inches deep and has a 4-inch pipe over it with center concentric with copper bolt. Tile is marked "Mississippi River Commission, U. S., 1895." The cap on pipe is marked "Mississippi River Commission, 1893."

△ East lump: This is on the largest lump lying near the outer bar and east of the entrance to Southwest Pass. It is marked by a 15-foot station and center is fixed by a nail in a yellow-pine 4 by 4 inch post driven firmly into the ground.

△ West lump: This is a 4 by 4 inch pine stake, point marked by copper rivet. A 15-foot station is built over the point. Post stands 20 meters from south end of lump. This lump is the west one of a group of four prominent ones.

△ Inner lump: This is near the south end of a long mud lump covered with brush. It is 78 meters from south end of lump and 3 meters from east side of lump. It is marked by a tile 4 by 18 by 18 inches with copper bolt in center. The tile is marked "Mississippi River Commission, U. S., 1895." It is set 36 inches below the surface. A 4-inch iron pipe is set over the copper bolt and resting on the tile. A cap on the top of pipe is marked "Mississippi River Commission, 1893." This point was established in April, 1898.

△ North lump: This is a 12-inch post buried 18 inches in ground on mud lump, 2 meters from north bluff bank of island and 30 meters from east point of island. It is marked with nail driven in top of post in center of triangle of 6 nails. The post projects 2 feet above surface of ground. This point was established in April, 1898.

TABLE 1.—*Survey of Southwest Pass, Mississippi River. Computation of triangle sides.*

Stations.	Observed angles.			Adjusted angles.			Log sine.	Log F.	Log length.	Length of sides.
	°	′	″	°	′	″				*Meters.*
△ Scott's Tower [a]	59	38	51	59	38	57	9.9359844	3.9605459	3.8965303	7,880.10
◬ Bayou Grande	73	20	42	73	20	48	9.9813910	....	3.9419369	8,748.57
◬ Doane	47	00	09	47	00	15	9.8641569	....	3.8246995	6,678.74
	179	59	42	180	00	00				
△ Willow	36	32	26	36	32	30	9.7748141	4.0498887	....	....
△ Scott's Tower	117	14	03	117	14	08	9.9489665	....	3.9988486	9,973.53
◬ Bayou Grande	26	13	18	26	13	22	9.6452870	....	3.6951691	4,956.43
	179	57	47	180	00	00				
△ Double Bayou	48	11	48	48	11	50	9.8724148	3.8227609	....	....
△ Willow	95	25	14	95	25	17	9.9980529	....	3.8208039	6,619.17
△ Scott's Tower	36	22	50	36	22	53	9.7731700	....	3.5959210	3,943.86
	179	59	52	180	00	00				
△ Pilot Tower	31	17	54	31	18	02	9.7156084	3.8803225	....	....
△ Double Bayou	61	29	22	61	29	30	9.9438642	....	3.8241735	6,670.74
△ Willow	87	12	20	87	12	28	9.9994841	....	3.8797934	7,582.17
	179	59	36	180	00	00				

[a] U. S. C. and G. S. (1866).

TABLE 1.—*Survey of Southwest Pass, Mississippi River, etc.*—Continued.

Stations.	Observed angles.			Adjusted angles.			Log sine.	Log F.	Log length.	Length of sides.
	°	′	″	°	′	″				*Meters.*
△North lump	39	56	07	39	56	13	9.8074972	4.0723094	....	....
△Pilot Tower	102	31	20	102	31	26	9.9895413	....	4.0618342	11,530.03
△Double Bayou	37	32	15	37	32	21	9.7848337	....	3.8571266	7,196.59
	179	59	42	180	00	00				
△East Point	91	20	31	91	20	36	9.9998806	3.8572625	....	....
△North lump	52	18	47	52	18	52	9.8983838	....	3.7556265	5,696.74
△Pilot Tower	36	20	28	36	20	32	9.7727667	....	3.6300094	4,265.89
	179	59	46	180	00	00				
△West lump	52	52	51	52	52	56	9.9016744	3.7283548	....	....
△East Point	65	31	46	65	31	52	9.9591303	....	3.6874620	4,869.25
△North lump	61	35	06	61	35	12	9.9442546	....	3.6725863	4,705.29
	179	59	43	180	00	00				
△East lump	68	33	21	68	33	26	9.9688484	3.7037610	....	....
△East Point	41	57	35	41	57	40	9.8251833	....	3.5289179	3,380.01
△West lump	69	28	49	69	28	54	9.9715357	....	3.6752703	4,734.46
	179	59	45	180	00	00				
△Inner lump	79	48	26	79	48	30	9.9930928	3.6822039	....	....
△East Point	55	53	58	55	54	02	9.9180648	....	3.6002390	3,983.26
△East lump	44	17	24	44	17	28	9.8440447	....	3.5262189	3,359.06
	179	59	48	180	00	00				
△Southwest Pass light	71	38	00	71	38	08	9.9772990	3.5489496	....	....
△East Point	78	26	21	78	26	28	9.9911016	....	3.5400182	3,467.51
△Inner lump	29	55	17	29	55	24	9.6979619	....	3.2468785	1,765.54
	179	59	38	180	00	00				
△C. P. 25	98	19	25	98	19	29	9.9953998	3.2515117	....	....
△Southwest Pass light	37	01	17	37	01	21	9.7796993	....	3.0311747	1,352.59
△East Point	44	39	05	44	39	10	9.8468371	....	3.0983125	1,254.05
	179	59	47	180	00	00				
△C. P. 22	86	33	10	86	33	13	9.9992139	3.0991349	....	....
△Southwest Pass light	55	39	26	55	39	29	9.9168147	....	3.0159100	1,037.32
△C. P. 25	37	47	15	37	47	18	9.7872806	....	2.8863759	769.80
	179	59	51	180	00	00				
△North Base	78	32	39	78	32	41	9.9912615	2.8951540	....	....
△Southwest Pass light	79	45	32	79	45	35	9.9930264	....	2.8881875	773.10
△C. P. 22 *a*	21	41	42	21	41	44	9.5678197	....	2.4629808	290.356
	179	59	53	180	00	00				
△Cheese	100	30	05	100	30	10	9.9926622	3.8320373	3.8246995	....
△Scotts Tower	31	45	06	31	45	12	9.7212032	....	3.5532405	3,574.70
△Bayou Grande	47	44	32	47	44	38	9.8693176	....	3.7013549	5,027.53
	179	59	43	180	00	00				
△Ockerson, 1898	58	11	10	58	11	10	9.9292988	3.7720561	....	....
△Cheese	86	25	16	86	25	15	9.9991520	....	3.7712081	5,904.84
△Scotts Tower	35	23	36	35	23	35	9.7628153	....	3.5348714	3,426.66
	180	00	02	180	00	00				
△Doane	43	33	28	43	33	40	9.8382998	3.6965716	....	....
△Ockerson	99	23	53	99	24	04	9.9941277	....	3.6906993	4,905.68
△Cheese	37	02	05	37	02	16	9.7798427	....	3.4764143	2,995.12
	179	59	26	180	00	00				
△Southeast lump	69	41	24	69	41	25	9.9721241	3.7081462	3.6752703	....
△East Point	75	14	13	75	14	14	9.9854216	....	3.6885678	4,881.66
△East lump	35	04	21	35	04	21	9.7593751	....	3.4625213	2,900.82
	179	59	58	180	00	00				

a Base computed from Doane-B. G.=290.385; 290.356 measured with steel tape on walk at Southwest Pass light-house. No correction made for temperature, which was about 78°.

TABLE 1.—*Survey of Southwest Pass, Mississippi River, etc.*—Continued.

Stations.	Observed angles.			Adjusted angles.			Log sine.	Log F.	Log length.	Length of sides.
	°	′	″	°	′	″				*Meters.*
△Southeast lump	66	16	47	66	16	50	9.9616707	3.7939558	3.7556265	....
△East Point	85	55	44	85	55	46	9.9989031	....	3.7928589	6,206.67
△Pilot Tower	27	47	22	27	47	24	9.6686023	....	3.4625581	2,901.07
	179	59	53	180	00	00				
△Beacon	71	47	33	....			9.9770922	3.2691863	3.2468785	....
△Southwest Pass light	43	31	52	....			9.8380605	....	3.1072468	1,280.11
△East Point	64	40	35	....			9.9561235	....	3.2253098	1,680.00
△Beacon	128	35	28	....			9.8929042	3.7370152	3.6300094	....
△North lump	13	33	50	....			9.3701974	....	3.1072126	1,280.01
△East Point	37	50	42	....			9.7878340	....	3.5248492	3,348.50
△Southwest Pass light	35	34	08	....			9.7646851	4.1151083	3.8797934	....
△Double Bayou	23	27	12	....			9.5998853	....	3.7149936	5,187.90
△Pilot Tower	120	58	40	....			9.9331668	....	4.0482751	11,175.70
	180	00	00	....						
P. B. M. No. 12	....			144	41	55	9.7618357	4.2864394	....	....
△Southwest Pass light	24	33	40	....			9.6187420	....	3.9051814	8,038.60
△Double Bayou	10	44	25	....			9.2703460	....	3.5567854	3,604.00
P. B. M. No. 11	....			140	28	45	9.8037020	4.2446731	....	....
△Southwest Pass light	22	18	15	....			9.5792381	....	3.8239112	6,666.70
△Double Bayou	17	13	00	....			9.4712710	....	3.7159441	5,199.30
P. B. M. No. 10	....			134	00	10	9.8569188	4.1913613	....	....
△Southwest Pass light	19	56	00	....			9.5326608	....	3.7240221	5,296.90
△Double Bayou	26	03	50	....			9.6428335	....	3.8341948	6,826.40
P. B. M. No. 9	6	00	00	63	36	00	9.9521683	3.6437527	3.5959210	....
△Willow	71	43	15	....			9.9775131	....	3.6212658	4,180.90
△Double Bayou	44	40	45	....			9.8470394	....	3.4907921	3,095.90
P. B. M. No. 8	....			90	31	50	9.9999814	3.5959396	3.5959210	....
△Willow	66	53	20	....			9.9630676	....	3.5590072	3,627.50
△Double Bayou	22	34	50	....			9.5843109	....	3.1802505	1,514.40
P. B. M. No. 7	....			100	00	50	9.9933329	3.8274710	3.8208039	....
△Scott's Tower	31	31	30	....			9.7183942	....	3.5458652	3,514.50
△Double Bayou	48	27	40	....			9.8741952	....	3.7016662	5,031.10
P. B. M. No. 6	....			75	34	47	9.9860974	3.6098236	3.5959210	....
△Willow	77	35	30	....			9.9897350	....	3.5995586	3,977.00
△Double Bayou	26	49	43	....			9.6544877	....	3.2643113	1,837.90
P. B. M. No. 5	....			48	54	22	9.8771602	3.7187608	....	....
△Willow	91	27	30	....			9.9998593	....	3.7186201	5,231.50
△Double Bayou	39	38	08	....			9.8047540	....	3.5235148	3,338.20
P. B. M. No. 4	....			49	36	00	9.8816918	3.6531929	3.5348847	....
△Ockerson	58	50	00	....			9.9323040	....	3.5854969	3,850.30
△Cheese	71	34	00	....			9.9771253	....	3.6303182	4,268.90
P. B. M. No. 3	....			71	16	00	9.9763608	3.5585239	3.5348847	....
△Ockerson	62	32	00	....			9.9480604	....	3.5065843	3,210.60
△Cheese	46	12	00	....			9.8583929	....	3.4169168	2,611.60
P. B. M. No. 2	....			81	39	00	9.9953717	3.5395130	3.5348847	....
△Ockerson	80	39	00	....			9.9941914	....	3.5337044	3,417.50
△Cheese	17	42	00	....			9.4829208	....	3.0224338	1,053.00

TABLE 2.—*Geographical positions, Southwest Pass survey, 1898.*

Station.	Latitude.			Seconds.	Longitude.			Seconds.	Azimuth.			Back azimuth.			To station.	Distance.
	°	'	"	*Meters.*	°	'	"	*Meters.*	°	'	"	°	'	"		*Meters.*
◬Doane (C. and G. S.)	29	09	06.19	190.6	89	18	56.91	1,538.1	348	46	46	168	47	13	◬Bayou Grande	7,880.1
									85	47	01	215	45	29	◬Scotts Tower	8,748.6
									7	08	04	187	07	53	◬Cheese	4,905.8
									50	41	44	230	41	02	◬Ockerson	2,995.2
◬Bayou Grande (C. and G. S.)	29	04	55.13	1,697.4	89	18	00.22	5.9	69	13	03	249	10	16	◬Willow	9,973.5
									95	26	25	275	24	26	◬Scotts Tower	6,678.7
									143	10	57	323	10	19	◬Cheese	3,574.7
◬Ockerson	29	08	04.56	140.4	89	15	22.65	612.3	28	16	16	208	15	26	◬Scotts Tower	5,906.0
									330	05	06	150	05	37	◬Cheese	3,426.8
◬Cheese	29	06	28.08	864.5	89	14	19.44	525.7	63	40	22	243	39	01	◬Scotts Tower	5,027.7
◬Scotts Tower	29	05	15.63	481.2	89	17	06.06	163.9	69	01	27	248	59	36	◬Double Bayou	6,619.2
									32	38	34	212	37	46	◬Willow	4,956.4
◬Willow	29	03	00.06	1.8	89	18	44.89	1,214.5	30	00	01	209	59	01	◬Pilot Tower	6,670.7
									117	12	29	297	11	26	◬Double Bayou	3,943.9
◬Double Bayou	29	03	58.61	1,804.5	89	20	54.55	1,475.6	36	13	17	216	11	15	◬North lump	11,530.0
									358	40	56	178	40	59	◬Pilot Tower	7,582.2
◬Pilot Tower	28	59	52.40	1,613.1	89	20	48.11	1,302.2	76	09	33	256	07	28	◬North lump	7,196.6
									39	49	01	219	47	56	◬East Point	5,696.7
									12	01	37	192	01	14	◬Southeast lump	
◬North lump	28	58	56.41	1,786.5	89	25	06.23	168.7	308	26	20	128	27	20	◬East Point	4,265.9
									10	01	32	190	01	16	◬West lump	4,869.2
◬West lump	28	56	20.66	636.0	89	26	37.53	1,016.4	312	23	07	132	23	51	◬East lump	3,380.0
									242	54	18	62	55	28	◬East Point	4,705.3
◬East lump	28	55	06.64	204.4	89	24	05.36	145.2	156	39	40	336	39	21	◬Inner lump	3,983.3
									200	57	17	20	57	48	◬East Point	4,734.5
									236	01	38	56	02	50	◬Southeast lump	
◬Inner lump	28	57	05.44	167.5	89	25	03.63	98.2	256	50	51	76	51	50	◬East Point	3,359.1
									226	55	27	46	56	12	◬Southwest Pass light	3,467.5
◬Southeast lump	28	56	35.22	1,084.2	89	21	35.87	971.3	125	44	16	305	43	34	◬East Point	
◬East Point	28	57	30.25	931.2	89	23	02.83	76.6	155	18	18	335	18	05	◬Southwest Pass light	1,765.5
									90	37	43	270	37	20	◬Beacon	1,280.1
◬Southwest Pass light	28	58	22.35	688.0	89	23	30.09	814.7	18	49	57	198	49	47	◬Beacon	1,680.0
◬Beacon	28	57	30.71	944.4	89	23	50.11	1,857.0								
P. B. M. No. 2	29	07	42.91	1,320.9	89	15	52.81	1,427.5								
P. B. M. No. 3	29	06	53.10	1,634.7	89	16	14.72	398.0								
P. B. M. No. 4	29	06	03.18	97.9	89	16	38.99	1.054.3								

TABLE 2.—*Geographical positions, Southwest Pass survey, 1898*—Continued.

Station.	Latitude.			Seconds.	Longitude.			Seconds.	Azimuth.			Back azimuth.			To station.	Distance.
	°	′	″	*Meters.*	°	′	″	*Meters.*	°	′	″	°	′	″		*Meters.*
P. B. M. No. 5	29	04	35.18	1,061.6	89	17	45.68	1,235.4								
P. B. M. No. 6	29	03	57.71	1,776.8	89	18	27.53	744.7								
P. B. M. No. 7	29	03	05.90	181.6	89	18	59.27	1,603.5								
P. B. M. No. 8	29	02	28.58	879.8	89	19	27.98	756.9								
P. B. M. No. 9	29	01	49.48	1,523.4	89	20	06.47	175.0								
P. B. M. No. 10	29	01	06.90	212.4	89	20	41.14	1,113.3								
P. B. M. No. 11	29	00	22.80	701.9	89	21	15.67	424.1								
P. B. M. No. 12	28	59	42.59	1,311.0	89	21	53.28	1,440.7								

SHORE LINE AND TOPOGRAPHY.

The shore line was run with transit and stadia, the line being checked by frequent connections with the trigonometrical points. The line of precise level bench marks along the west bank of the pass served as a base line for this work.

At the Gulf end of the land the outlines of the reeds were located by means of long-distance readings and intersections from established points. The outlines of the mud lumps which lie off the mouth of the Pass were all carefully determined. Some of these lumps are 5 to 7 feet above high tide, and those nearest shore are covered with a very thick growth of mangrove. Stake Island is an old mud lump grown up with small trees, brush, and briers. It seems to be very firm and stable. Many of the other lumps show signs of disintegration by sliding back in vertical slices to the depths from which they came. The point of least resistance to these slides seems to be near the center of the lump, and it is common to find the outer rim of the lump considerably higher than the inner area, thus giving the lump the appearance of a redoubt.

The surface of the high lumps is composed of the silt usually found in the bed of the stream. The lower stratum is a very fine plastic clay of a bluish color. This clay resists the wave wash remarkably well.

On nearly all of the lumps there are holes from which inflammable gases escape. Many of the lumps near the outer edge of the bar are just awash, while others are submerged to such a depth that their presence is only shown during rough weather. These are scattered about near the entrance to the pass and are dangerous to approaching vessels.

Some of these lumps are the resting places of myriads of pelicans, gulls, ducks, and other fowls.

Prints are appended showing West lump and vicinity.

The banks of the pass itself are quite low and at a medium stage of river they overflow at high tide for nearly the entire length. On the right bank there is a growth of willows covering a narrow strip and extending down to Scotts Canal, a distance of about 3 miles below Head of Passes light-house. On the left bank there are a few scattering clumps of willows of scrubby growth down as far as Double Bayou, a distance of about 8 miles below the light. The remaining portions of the bank are covered with a very dense growth of sea cane, which is almost impenetrable to the surveyor without tedious cutting. This cane grows to a height of 8 to 12 feet and the stalks reach a diameter of half to three-quarters of an inch. The growth is confined to the higher portions of the river banks and the banks of the bayous which put out from the main pass to the Gulf. In many places its growth is confined to a very narrow strip only a few feet wide along the immediate banks.

The first opening from the pass to the Gulf is Scotts Canal, on the right bank, about 3¼ miles below the Head of Passes. This was originally an artificial outlet of sufficient size to admit of the passage of small vessels. A growth of willows extends out along its banks for a mile or more. At the present time it is nearly filled up at the pass end and water from the pass enters it only at high tide.

The next opening from the pass is Bayou Joseph, on the left bank, about 3.9 miles below Head of Passes light. This is also said to be an artificial opening. At the head it is about 100 feet wide and has a maximum depth of 26 feet.

The next outlet is called Double Bayou. This is on the right bank, 8.2 miles below Head of Passes light. It is about 160 feet wide where it leaves the pass, but soon narrows down to about 100 feet. It has a central depth at the upper end of about 18 feet, but shoals up gradually toward the Gulf, and at the mouth is only about a foot deep at low tide. The Gulf end of this bayou is now about half a mile west of the position given by the Coast Survey in their survey of 1867.

On the left bank, 10.8 miles below Head of Passes light, is a small bayou known as Custom-House Bayou. This bayou is about 125 feet wide, and has a depth of about 4 feet.

Pilot Town Bayou is also on the left bank, about 11.6 miles below Head of Passes light. It has a width of about 80 feet near the upper end and has a central depth of about 6 feet. It is only about 3,000 feet long, and the current through it at low tide is very swift.

Between Pilot Town Bayou and land's end at East Point there are four openings in the left bank from the pass to the Gulf. The first one, 12.5 miles from Head of Passes, is about 50 feet wide and 4 feet deep; the second, 12.7 miles, with central depth of about 4 feet and width of 325 feet; the third, 13.4 miles, with central depth of 6 feet, and width at a point halfway to the Gulf of 260 feet; the fourth, 13.6 miles, has a central depth of 7 feet and a width of about 200 feet.

On the right bank, 13.9 miles below the Head of Passes light, is Light-House Bayou, which is about 1 mile long. It is a good navigable channel down to the light-house dock, and for a distance of a quarter of a mile farther down. It is 240 feet wide and about 10 feet deep.

All of the above bayous are very shallow where they join the Gulf.

Another small bayou, 40 feet wide, leaves the right bank at 14.5 miles below Head of Passes light-house.

A wide break occurs in the right bank about 15 miles below Head of Passes light-house. It is about 2,000 feet wide where it leaves the pass, and finally divides up into several smaller openings. The water is only about 2 feet deep.

The reed-covered land terminates on the left bank at a point 15 miles below the Head of Passes light-house. On the right bank the extreme point of land is about three-quarters of a mile farther down.

PRECISE LEVELS.

A line of levels was run from the bench marks at Head of Passes to Stake Island. These levels were run with a high-grade instrument, and the method followed was that used in the highest grade of primary level work. In spite of the fact that the ground was sometimes quite soft, the results obtained in leveling compared very favorably with the best results usually attained in precise level work. Tile and pipe bench marks were set at intervals of about 1 mile along the right bank. Each stretch between successive bench marks was leveled in duplicate by running the line in opposite directions with the greatest possible care.

Bench marks were established at the light-house dock, Southwest Pass light-house, and the beacon on Stake Island.

While the flat tile bench marks have been found to be the most stable form of bench used on the survey of the river, the question of their stability in such ground as is found along the Southwest Pass is still an open one. It seems probable that changes in the elevation of some of them will occur. The final bench on Stake Island should maintain its elevation if the island itself does not change.

Descriptions and elevations of bench marks are given in the following tabulation:

DESCRIPTIONS AND ELEVATIONS OF PRECISE BENCH MARKS BETWEEN THE HEAD OF THE PASSES AND STAKE ISLAND AT THE MOUTH OF SOUTHWEST PASS.

[NOTE.—Elevations are given in meters and feet above Cairo datum plane. To reduce to mean gulf level at Biloxi, Miss., subtract 21.26 feet (preliminary value) from the elevation here given. One meter = 3.2808693 feet. The term "P. B. M." denotes a precise bench mark, which is set with special care so as to be practically permanent. In most cases a P. B. M. consists of a vitrified tile 18 by 18 by 4 inches, in the center of which is set vertically with lead a ¾-inch copper bolt, the upper end being about flush with the upper surface of the tile. Surrounding the bolt on the surface of the tile is the inscription "Mississippi River Commission." This tile is buried in the ground from 1 to 3 feet beneath the surface, the depth varying with the nature of the material. On top of the tile a 4-inch wrought iron gas pipe 4 feet long is set concentric with the copper bolt; the lower end of the pipe, which is expanded somewhat like a boiler tube, fitting in a circular groove molded in the tile. A cast-iron cap fits over the top of the pipe and is fastened thereto with bronze bolts. The elevation of the top of the cap is also determined.

The term "T. B. M." denotes a temporary bench mark, whose elevation is as well determined as that of a P. B. M., but is not regarded permanent. They consist of nails in roots of trees or stakes driven in the ground.]

B. M. "Fire," established by Lieutenant Davis December 8, 1875, and is described as the westerly of two bricks, marked "Fire," in step of light-house foundation, west side, called foundation of astronomical station by Coast Survey.

B. M. "Fire" is 10 meters north of P. B. M. 1, about 1 meter west of line of fence on west side of light-house yard, produced. It is the top of the outside one of two bricks marked Belo Fire Belo Fire in step of circular foundation of old light house at Head of Passes, west side of South Pass. Elevation, 6.7644 meters—22.193 feet.

P. B. M. 1 (Paige) is a tile and pipe set in the northwest corner of the yard surrounding Head of Passes light-house, one meter from each fence, 52 meters from the northwest corner of the light-house. Elevation, 6.4813 meters—21.264 feet.

P. B. M. 1 A is top of cap on top of pipe over P. B. M. 1, described above. Elevation, 7.6884 meters, 25.225 feet.

B. M., Head of Passes light-house, is a + cut in top brick in the northeast corner of Head of Passes light-house foundation; is in north end of brick farthest east and about one meter above ground. Elevation, 8.1212 meters, 26.644 feet.

U. S. Engineers' gauge, Head of Passes, is a staff gauge fastened to foundation post of tide gauge house at head of South Pass, Louisiana, 150 meters northeast of Head of Passes light-house. Elevation of zero, 19.074 feet.

P. B. M., Southwest Pass, No. 1 is tile and pipe on right bank of Southwest Pass, 62 meters from river bank, 10 meters from edge of swamp, 2,000 meters below △ Donovan No. 2, 300 meters below a point which is directly opposite the Head of Passes light-house. Six-inch willow is 1 meter west, blazed with triangle facing P. B. M. Elevation, 6.4166 meters, 21.052 feet. Elevation of cap, 7.6277 meters, 25.025 feet.

P. B. M., Southwest Pass, No. 2 is tile and pipe on right bank of Southwest Pass, about 1¼ miles below Head of Passes light-house, 10 meters from edge of water, 2 meters back of 10-inch ash tree blazed with triangle facing P. B. M. Elevation, 6.5963 meters, 21.642 feet. Elevation of cap, 7.8073 meters, 25.615 feet.

P. B. M., Southwest Pass, No. 3 is tile and pipe on right bank of Southwest Pass, about 2¼ miles below Head of Passes light-house, 15 meters from water's edge, 10 meters back and 2 meters above sounding flag 29, which is marked with iron pipe. Elevation, 6.5908 meters, 21.624 feet. Elevation of cap, 7.8011 meters, 25.594 feet.

P. B. M., Southwest Pass, No. 4 is tile and pipe on right bank of Southwest Pass, about 3¼ miles below Head of Passes light-house, 17 meters from water's edge, 15 meters below Scotts Canal. Elevation, 6.3848 meters, 20.948 feet. Elevation of cap, 7.5929 meters, 24.911 feet.

Triangle, Scott's Tower, is a tile and pipe on the right bank of Southwest Pass, about 105 meters above Scott's house. It is about 10 feet below upper angle in levee which surrounds the house and on the line running between the house and the pass. It is marked by a 30-foot station. Elevation, 6.5212 meters, 21.395 feet. Elevation of cap, 7.7288 meters, 25.357 feet.

T. B. M. 303 is a wire nail in east side of 12-inch leaning willow tree, on river bank, 30 meters below Scott's house, 113 meters below △ Scott's Tower, 14 meters above sounding flag 52. Elevation, 7.2595 meters, 23.818 feet.

P. B. M., Southwest Pass, No. 5 is tile and pipe on right bank of Southwest Pass, 1 mile below Scott's house, 10 meters from water's edge, 3 meters above and 3 meters back of 12-inch willow blazed with triangle facing P. B. M. Elevation, 6.3201 meters, 20.735 feet. Elevation of cap, 7.5298 meters, 24.704 feet.

P. B. M., Southwest Pass, No. 6, is tile and pipe on right bank of Southwest Pass, 2 miles below Scott's house, 15 meters from water's edge, 30 meters below sounding flag 73. Elevation, 6.3048 meters, 20.685 feet. Elevation of cap, 7.5078 meters, 24.632 feet.

P. B. M., Southwest Pass, No. 7, is tile and pipe on right bank of Southwest Pass, about 3½ miles below Scott's house, on small point opposite △ willow, 13 meters from water's edge. Elevation, 6.5198 meters, 21.390 feet. Elevation of cap, 7.7269 meters, 25.351 feet.

P. B. M., Southwest Pass, No. 8, is tile and pipe on right bank of Southwest Pass, 323 meters below Double Bayou, 15 meters from water's edge, 65 meters above sounding flag 95. Elevation, 6.1006 meters, 20.015 feet. Elevation of cap, 7.3106 meters, 23.985 feet.

P. B. M., Southwest Pass, No. 9, is tile and pipe on right bank of Southwest Pass, 1½ miles below Double Bayou, 8 meters from water's edge, 54 meters above sounding flag 106. Elevation, 6.2961 meters, 20.657 feet. Elevation of cap, 7.5061 meters, 24.626 feet.

P. B. M., Southwest Pass, No. 10, is tile and pipe on right bank of Southwest Pass, about 2½ miles below Double Bayou, 16 meters from water's edge, 50 meters below sounding flag 116. Elevation, 6.1649 meters, 20.226 feet. Elevation of cap, 7.3732 meters, 24.190 feet.

P. B. M., Southwest Pass, No. 11, is tile and pipe on right bank of Southwest Pass, about 300 meters above upper end of Pilot Town, 20 meters from water's edge, about 65 meters above sounding flag 128. Elevation, 6.2702 meters, 20.572 feet. Elevation of cap, 7.4794 meters, 24.539 feet.

P. B. M., Southwest Pass, No. 12, is a tile and pipe on right bank of Southwest Pass, opposite a point about three-quarters of a mile below Pilot Town, about 100 meters below old telegraph station, 10 meters back of sounding flag 138. Elevation, 6.3123 meters, 20.710 feet. Elevation of cap, 7.5176 meters, 24.664 feet.

P. B. M., Southwest Pass, No. 13, is a tile and pipe on left bank of Light-house Bayou, 4 meters above walk leading back to light-house, 5 meters from water's edge, 7 meters east of small house at junction of walk and dock, at southeast corner of small platform used for workshop. Cap marked "B. M. 1893." Elevation, 6.1786 meters, 20.271 feet Elevation of cap, 7.3905 meters, 24.247 feet.

P. B. M., Southwest Pass, No. 14, is on Southwest Pass Light-house. It is the bottom of a shallow, round cavity cut in base of column on north side of light-house, on east side of walk, directly under arrow cut in side of column. P. B. M. is about 2 inches above bedplate on which the column rests. Elevation, 6.5314 meters, 21.429 feet.

P. B. M., Southwest Pass, No. 15 is a tile and pipe on Stake Island, 12½ meters north of north corner of beacon, 4 meters east of west edge of brush, 1 meter north of line of Southwest Pass Light-House and C. P. 24, produced, and 21½ meters from C. P. 24, which is marked with a 2-inch gas pipe. Elevation, 6.7041 meters (21.995 feet). Elevation of cap, 7.9149 meters, 25.968 feet.

P. B. M., Southwest Pass, No. 16 is a + cut in top of one of the bolts which hold cap on iron pile under north corner of iron beacon on Stake Island, on corner of beacon nearest Southwest Pass Light-House. Top of bolt is 31½ millimeters above top of cap. Elevation, 7.3923 meters, 24.253 feet.

Elevations of tops of gas-pipe sounding ranges.

Bench mark.	Determined from—	Difference of elevation.	Elevation above Cairo datum.	Elevation above Cairo datum.
Right bank, top of 2-inch gas pipe, at sounding flag—		*Millimeters.*	*Meters.*	*Feet.*
7	T. B. M. 279	+435.6	7.6980	25.256
9	do	+240.0	7.5024	24.614
11	do	+353.9	7.6168	24.985
13	do	+306.8	7.5692	24.834
15	do	+329.1	7.5825	24.877
29	T. B. M. 299	+621.0	7.5704	24.838
34	T. B. M. 300	+435.7	7.4953	24.591
36	do	+500.6	7.5602	24.804
38	do	+452.7	7.5123	24.647
43	T. B. M. 302	+465.0	7.5584	24.798
44	do	+544.7	7.6381	25.060
46	do	+438.0	7.5314	24.710
48	do	+466.7	7.5601	24.804
50	do	+491.3	7.5847	24.884
52	T. B. M. 304	+623.4	7.5517	24.776
53	do	+681.1	7.6094	24.965
55	do	+700.6	7.6289	25.029
57	do	+640.5	7.5688	24.832
64	Cap P. B. M. 5	— 26.2	7.5036	24.618
66	do	— 23.9	7.5059	24.626
68	do	+ 8.7	7.5385	24.735
70	do	— 39.2	7.4906	24.576
72	T. B. M. 305	+349.6	7.4958	24.593
77	T. B. M. 306	+570.4	7.4516	24.448
79	T. B. M. 307	+596.8	7.5487	24.767
80	do	+514.2	7.4661	24.496
81	do	+454.1	7.4060	24.299
88	T. B. M. 308	+667.7	7.5397	24.737

The positions of sounding flags 1, 3, 5, 7, 9, 11, 13, 15, and from 16 to 164, inclusive, on right bank of Southwest Pass, are marked by 2-inch gas pipes, from 4 to 5 feet long, driven into the ground so as to stand 2 feet above the surface. A reading was taken on the top of some of these pipes (whose numbers are given in the above tabulation) as a side shot while running the precise levels, and their elevations have been deduced from the precise level notes.

TABULATION OF RESULTS, HEAD OF PASSES TO STAKE ISLAND AT MOUTH OF SOUTHWEST PASS.

NOTE.—In the tabulations of results the reductions have been made from the bench mark B. M. "Fire" at Head of Passes to P. B. M. Southwest Pass, No. 16, on Stake Island at the mouth of Southwest Pass. B. M. "Fire" is the starting point, and its elevation, 6.7664 meters, is that obtained by the final computations of the line of precise levels from B. M. City Stone "Halfway House" at Metaire Cemetery, New Orleans, La., to Head of Passes, run in 1898, and taking the 1882 elevation of B. M. City Stone "Halfway House," 7.9870 meters, as correct.

Column 1 gives the bench mark under consideration in the consecutive order in which their elevations were deduced.

Column 2 gives the bench mark from which the elevation of the bench mark in column 1 is determined.

Column 3 gives the length in meters of line run between bench marks in columns 1 and 2.

Column 4 gives the total length of side line run, in meters.

Column 5 gives the total length of main line run, in kilometers, from the starting point to the bench mark under consideration.

Column 6 gives the direction each line was run. The abbreviation "Dir." is for "direct line," or line run from bench mark in column 2 to bench mark in column 1, and the abbreviation "Rev." is for "reverse line," or line run in the opposite direction to that of the direct line.

Column 7 gives the difference in elevation between the bench marks in columns 1 and 2, also the mean difference in elevation, in millimeters.

Column 8 gives the residuals, in millimeters, found by subtracting each result from the mean result.

Columns 9 and 10 give the algebraic sum of the residuals in the main line from the starting point to the bench mark under consideration.

Column 11 gives the elevation of the bench mark in column 1, in meters, above the Cairo datum plane.

Column 12 gives the elevation of the bench mark in column 1, in feet, above the Cairo datum plane.

Column 13 indicates the observer, "W" being W. S. Williams, and "T" being E. J. Thomas.

Instrument used by W. S. Williams was Kern level, No. 4; bubble, No. 214, Fauth.

Instrument used by E. J. Thomas was Kern level, No. 5; bubble, No. 5, Kern.

Instrumental constants determined April 18 and 20, 1898, are as follows:

Kern level, No. 4: Stadia interval, 4.29 mm. intercepted on rod equal 1 meter; correction P, due to inequality of collars of telescope, equal — 0.045 mm. per meter.

Kern level, No. 5: Stadia interval, 4.665 mm. intercepted on rod equal 1 meter; correction P, equal — 0.0028 mm. per meter.

Bubble, No. 5, Kern: Value of 1 division in seconds = 1.85″; correction, 0.00898 mm. per meter.

Bubble, No. 214, Fauth: Value of 1 division in seconds = 2.66″; correction, 0.01290 mm. per meter.

Bench mark.	Determined from—	Length of stretch.	Total length side line.	Total distance main line.	Direction of line.	Difference of elevation.	Residuals V.	Σv		Elevation above Cairo datum plane.		Observer.
								Direct line.	Reverse line.			
		Meters.	Meters.	Km.		Mm.	Mm.	Mm.	Mm.	Meters.	Feet.	
B. M. "Fire"										6.7664	22.199	
T. B. M. 281	P. B. M. "Fire"	51	....	0.051	Dir	+ 217.8	−0.05	−0.05	+0.05	6.98215	....	W.
					Rev	+ 217.7	+ .05					
					Mean	+ 217.75						
P. B. M. 1 (Paige)	T. B. M. 281	45	45	....	Dir	− 500.5	− .35	....	....	6.48330	21.270	W.
					Rev	− 501.2	+ .35					
					Mean	− 500.85						
P. B. M. 1 A	do	45	90	....	Dir	+ 706.3	− .05	....	....	7.69040	25.231	W.
					Rev	+ 706.2	+ .05					
					Mean	+ 706.25						
B. M. Head of Passes Light-House	do	12	102	....	Dir	+1,139	.00	....	....	8.12315	26.650	W.
					Rev	+1,139	.00					
					Mean	+1,139						
5-foot mark on Head of Passes gauge	do	150	252	....	Dir	+ 356	− .35	....	....	7.33980	24.080	W.
					Rev	+ 355.3	+ .35					
					Mean	+ 355.65						
T. B. M. 280	do	370	....	.421	Dir	+ 837	+ .15	+ .10	− .10	7.81980	....	W.
					Rev	+ 837.3	− .15					
					Mean	+ 837.15						

Tabulation of results, Head of Passes to Stake Island at mouth of Southwest Pass—Continued.

Bench mark.	Determined from—	Length of stretch.	Total length side line.	Total distance main line.	Direction of line.	Difference of elevation.	Residuals V.	Σv		Elevation above Cairo datum plane.		Observer.
								Direct line.	Reverse line.			
		Meters.	*Meters.*	*Km.*		*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Meters.*	*Feet.*	
T. B. M. 279	T. B. M. 280	660	....	1.081	1 Dir	— 57.2	+ .32	+2.38	—2.38	7.26242	....	W. and T.
					1 Rev	— 56.5	— .38					
					2 Dir	— 61.1	+4.22					
					2 Rev	— 52.7	—4.18		(River crossing over Southwest Pass.)			
					Mean	— 56.88						
P. B. M., Southwest Pass, No. 1	T. B. M. 279	52	304	....	Dir	— 845.7	— .15	....	....	6.41857	21.058	T.
					Rev	— 846	+ .15					
					Mean	— 845.85						
Cap P. B. M., Southwest Pass, No. 1	do	52	356	....	Dir	+ 365.3	.00	....	....	7.62972	25.031	T.
					Rev	+ 365.3	.00					
					Mean	+ 365.3						
T. B. M. 297	do	1,705	....	2.786	Dir	— 123.8	—2.10	+ .28	— .28	7.13652	....	W.
					Rev	— 128	+2.10					
					Mean	— 125.9						
P. B. M. Southwest Pass, No. 2	T. B. M. 297	14	370	....	Dir	— 540.1	—0.10	....	....	6.59632	21.642	W.
					Rev	— 540.3	+0.10					
					Mean	— 540.2						
Cap P. B. M. Southwest Pass, No. 2	do	14	384	....	Dir	+ 670.7	+0.05	....	....	7.80727	25.615	W.
					Rev	+ 670.8	—0.05					
					Mean	+ 670.75						
T. B. M. 298	do	1,225	....	4.011	Dir	+ 208	—1.15	— .87	+ .87	7.34337	....	W.
					Rev	+ 205.7	+1.15					
					Mean	+ 206.85						
T. B. M. 299	T. B. M. 298	455	....	4.466	Dir	— 393.7	— .25	—1.12	+1.12	6.94942	....	W.
					Rev	— 394.2	+ .25					
					Mean	— 393.95						
P. B. M., Southwest Pass, No. 3	T. B. M. 299	27	411	....	Dir	— 358.6	— .05	....	....	6.59077	21.624	W.
					Rev	— 358.7	+ .05					
					Mean	— 358.65						
Cap P. B. M., Southwest Pass, No. 3	do	27	438	....	Dir	+ 851.8	— .15	....	....	7.80107	25.594	W.
					Rev	+ 851.5	+ .15					
					Mean	+ 851.65						
T. B. M. 300	do	722	....	5.188	Dir	+ 109.7	+ .50	— .62	+ .62	7.05962	....	W.
					Rev	+ 110.7	— .50					
					Mean	+ 110.20						
T. B. M. 301	T. B. M. 300	941	....	6.129	Dir	+ 360.8	+ .45	— .17	+ .17	7.42087	....	W.
					Rev	+ 361.7	— .45					
					Mean	+ 361.25						
P. B. M., Southwest Pass, No. 4	T. B. M. 301	16	454	....	Dir	—1,036.1	+ .05	....	....	6.38482	20.948	W.
					Rev	—1,036	— .05					
					Mean	—1,036.05						

Cap P. B. M., Southwest Pass, No. 4	.....do	16	470	....	Dir	+ 171.8	+ .20	....	....	7.59287	24.911	W.
					Rev	+ 172.2	— .20					
					Mean	+ 172						
T. B. M. 302	.....do	509	....	6.638	Dir	— 327.2	— .30	— .47	+ .47	7.09337	....	W.
					Rev	— 327.8	+ .30					
					Mean	— 327.5						
T. B. M. 303	T. B. M. 302	1,265	....	7.903	Dir	+ 166.5	— .35	— .82	+ .82	7.25952	23.818	W.
					Rev	+ 165.8	+ .35					
					Mean	+ 166.15						
△Scott's Tower	T. B. M. 303	113	583	....	Dir	— 738.5	+ .15	....	....	6.52117	21.395	W.
					Rev	— 738.2	— .15					
					Mean	— 738.35						
Cap△Scott's Tower	.....do	113	696	....	Dir	+ 469.5	— .25	....	....	7.72877	25.357	W.
					Rev	+ 469	+ .25					
					Mean	+ 469.25						
4-foot patrol gauge at Scott's House	.....do	14	710	....	Dir	+ 178.2	— .20	....	....	7.43752	24.402	W.
					Rev	+ 177.8	+ .20					
					Mean	+ 178						
T. B. M. 304	.....do	1,457	....	9.360	Dir	— 331.7	+ .45	— .37	+ .37	6.92827	23.731	W.
					Rev	— 330.8	— .45					
					Mean	— 331.25						
P. B. M., Southwest Pass, No. 5	T. B. M. 304	92	802	....	Dir	— 608.3	+ .15	....	....	6.32012	20.735	W.
					Rev	— 608	— .15					
					Mean	— 608.15						
Cap P. B. M., Southwest Pass, No. 5	.....do	92	894	....	Dir	+ 601.5	.00	— .37	+ .37	7.52977	24.704	W.
					Rev	+ 601.5	.00					
					Mean	+ 601.5						
T. B. M. 305	Cap P. B. M. No. 5	1,330	....	10.690	Dir	— 383	— .60	— .97	+ .97	7.14617	....	W.
					Rev	— 384.2	+ .60					
					Mean	— 383.6						
T. B. M. 306	T. B. M. 305	299	....	10.989	Dir	— 265.3	+ .30	— .67	+ .67	6.88117	22.576	W.
					Rev	— 264.7	— .30					
					Mean	— 265						
P. B. M., Southwest Pass, No. 6	T. B. M. 306	10	904	....	Dir	— 577.3	— .10	....	....	6.30377	20.682	W.
					Rev	— 577.5	+ .10					
					Mean	— 577.4						
Cap P. B. M., Southwest Pass, No. 6	.....do	10	914	....	Dir	+ 625.3	+ .35	....	....	7.50682	24.629	W.
					Rev	+ 626	— .35					
					Mean	+ 625.65						
T. B. M. 307	.....do	615	....	11.604	Dir	+ 70.6	+ .10	— .57	+ .57	6.95187	....	W.
					Rev	+ 70.8	— .10					
					Mean	+ 70.7						
T. B. M. 308	T. B. M. 307	1,228	....	12.832	Dir	— 79.7	— .15	— .72	+ .72	6.87202	....	W.
					Rev	— 80	+ .15					
					Mean	— 79.85						
P. B. M., Southwest Pass, No. 7	T. B. M. 308	23	937	....	Dir	— 353	— .25	....	....	6.51877	21.387	W.
					Rev	— 353.5	+ .25					
					Mean	— 353.25						
Cap P. B. M., Southwest Pass, No. 7	.....do	23	960	....	Dir	+ 853.7	+ .15	....	....	7.72687	25.348	W.
					Rev	+ 854	— .15					
					Mean	+ 853.85						

Tabulation of results, Head of Passes to Stake Island at mouth of Southwest Pass—Continued.

Bench mark.	Determined from—	Length of stretch.	Total length side line.	Total distance main line.	Direction of line.	Difference of elevation.	Residuals V.	Σv		Elevation above Cairo datum plane.		Observer.
								Direct line.	Reverse line.			
		Meters.	*Meters.*	*Km.*		*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Meters.*	*Feet.*	
T. B. M. 309	T. B. M. 308	1,262		14.094	Dir	— 182.2	— .40	—1.12	+1.12	6.68942		W.
					Rev	— 183	+ .40					
					Mean	— 182.6						
P. B. M., Southwest Pass, No. 8	T. B. M. 309	155	1,115		Dir	— 590.2	+ .85			6.09957	20.012	W.
					Rev	— 589.5	— .85					
					Mean	— 589.85						
Cap P. B. M., Southwest Pass, No. 8	do	155		14.249	Dir	+ 619.8	+ .35	— .77	+ .77	7.30957	23.982	W.
					Rev	+ 620.5	— .35					
					Mean	+ 620.15						
T. B. M. 310	Cap P. B. M. No. 8	1,506		15.755	Dir	— 501.5	—2.15	—2.92	+2.92	6.80592		W.
					Rev	— 505.8	+2.15					
					Mean	— 503.65						
P. B. M., Southwest Pass, No. 9	T. B. M. 310	100	1,215		Dir	— 511	+ .15			6.29507	20.654	W.
					Rev	— 510.7	— .15					
					Mean	— 510.85						
Cap P. B. M., Southwest Pass, No. 9	do	100	1,315		Dir	+ 699.3	— .15			7.50507	24.623	W.
					Rev	+ 699	+ .15					
					Mean	+ 699.15						
T. B. M. 311	do	1,263		17.018	Dir	— 70.8	—1.20	—4.12	+4.12	6.73392		W.
					Rev	— 73.2	+1.20					
					Mean	— 72						
T. B. M. 312	T. B. M. 311	433		17.451	Dir	— 44.7	+ .95	—3.17	+3.17	6.69017		W.
					Rev	— 42.8	— .95					
					Mean	— 43.75						
P. B. M., Southwest Pass, No. 10	T. B. M. 312	32	1,347		Dir	— 526.1	— .20			6.16387	20.223	W.
					Rev	— 526.5	+ .20					
					Mean	— 526.3						
Cap P. B. M., Southwest Pass, No. 10	do	32	1,379		Dir	+ 685	.00			7.37217	24.187	W.
					Rev	+ 685	.00					
					Mean	+ 685						
T. B. M. 313	do	432		17.933	Dir	+ 82.8	+ .70	—2.47	+2.47	6.77367		W.
					Rev	+ 84.2	— .70					
					Mean	+ 83.5						
T. B. M. 314	T. B. M. 313	1,211		19.144	Dir	— 111.5	— .40	—2.87	+2.87	6.66177		W.
					Rev	— 112.3	+ .40					
					Mean	— 111.9						
P. B. M., Southwest Pass, No. 11	T. B. M. 314	8	1,387		Dir	— 392.5	— .05			6.26922	20.569	W.
					Rev	— 392.6	+ .05					
					Mean	— 392.55						
Cap P. B. M., Southwest Pass, No. 11	do	8	1,395		Dir	+ 816.7	— .10			7.47887	24.536	W.
					Rev	+ 816.5	+ .10					
					Mean	+ 816.6						

T. B. M. 315	do	1,633		20.777	Dir	— 2	.00	—2.87	+2.87	6.65077		W.
					Rev	— 2	.00					
					Mean	— 2						
P. B. M., Southwest Pass, No. 12	T. B. M. 315	12	1,407		Dir	— 348.2	— .25			6.31182	20.707	W.
					Rev	— 348.7	+ .25					
					Mean	— 348.45						
Cap P. B. M., Southwest Pass, No. 12	do	12	1,419		Dir	+ 857	— .15			7.51662	24.661	W.
					Rev	+ 856.7	+ .15					
					Mean	+ 856.85						
T. B. M. 316	do	1,166		21.943	Dir	+ 117.5	— .15	—3.02	+3.02	6.54212		W.
					Rev	— 117.8	— .15					
					Mean	— 117.65						
T. B. M. 317	T. B. M. 316	1,354		23.297	Dir	+ 151.8	—1.00	—4.02	+4.02	6.69292		W.
					Rev	+ 149.8	+1.00					
					Mean	+ 150.8						
T. B. M. 318	T. B. M. 317	832		24.129	Dir	— 88.2	— .30	—4.32	+4.32	6.60442		W.
					Rev	— 88.8	+ .30					
					Mean	— 88.5						
T. B. M. 321	T. B. M. 318	476	1,805		Dir	+ 3	+ .15	—4.17	+4.17	6.60757		W.
					Rev	+ 3.3	— .15					
					Mean	+ 3.15						
P. B. M., Southwest Pass, No. 13	T. B. M. 321	45	1,940		Dir	— 430	.00	—4.17	+4.17	6.17757	20.268	W.
					Rev	— 430	.00					
					Mean	— 430						
Cap P. B. M., Southwest Pass, No. 13	do	45	1,985		Dir	+ 782	— .10	—4.27	+4.27	7.38917	24.244	W.
					Rev	+ 781.8	+ .10					
					Mean	+ 781.90						
4-foot mark patrol gauge at Light-House Bayou.	do	48	2,033		Dir	+ 312.1	+ .05			6.91972	22.701	W.
					Rev	+ 312.2	— .05					
					Mean	+ 312.15						
P. B. M., Southwest Pass, No. 14	do	323	2,356		Dir	— 77.7	+ .50	—3.67	+3.67	6.53037	21.426	W.
					Rev	— 76.7	— .50					
					Mean	— 77.2						
T. B. M. 319	T. B. M. 318	1,314		25.443	Dir	+ 37.7	— .85	—5.17	+5.17	6.64127		W.
					Rev	+ 36	+ .85					
					Mean	+ 36.85						
T. B. M. 320	T. B. M. 319	1,066		26.509	Dir	+ 69.8	— .65	—5.82	+5.82	6.71042		W.
					Rev	+ 68.5	+ .65					
					Mean	+ 69.15						
P. B. M., Southwest Pass, No. 15	T. B. M. 320	27	2,383		Dir	— 7.5	+ .15	—5.67	+5.67	6.70307	21.992	W.
					Rev	— 7.2	— .15					
					Mean	— 7.35						
Cap P. B. M., Southwest Pass, No. 15	do	27	2,410		Dir	+1,203.3	+ .20	—5.62	+5.62	7.91892	25.965	W.
					Rev	+1,203.7	— .20					
					Mean	+1,203.5						
P. B. M., Southwest Pass	do	37		26.546	Dir	+ 681	— .15	—5.97	+5.97	7.39127	24.250	W.
					Rev	+ 680.7	+ .15					
					Mean	+ 680.85						
			a 1.5	a 16.5								

a Miles.

HYDROGRAPHY.

The steam launch *General Reese* was used in taking soundings. A temporary platform was put in on the forward deck so as to make room for two leadsmen. These leadsmen made their casts alternately, and by this means a good rate of speed could be maintained without leaving too much space between successive soundings. A 7-pound mushroom lead was used in shallow water, and in the deep, swift water a lead weighing 20 pounds was used.

The launch was guided on range by a flagman on each bank of the pass. The extremities of the sounding lines in the pass and the main river were fixed and marked by the shore-line party.

The lines running out into the Gulf were fixed by anchoring a sailboat at the proper point for each line and running the line on a range through the sailboat and the Stake Island beacon or the light-house. The soundings on these outer lines were located by means of three transits placed at suitable points to give the best intersections. The soundings in the main river above the Head of Passes and in the wide portions of Southwest Pass were located by means of two transits and the range line, which the boat invariably followed.

In the narrow portions of the pass the soundings were located by reading distances simultaneously from each shore end of the lines to the sounding boat, which was always kept on range. This method gives two independent determinations of the position and gives a further check, as the sum of the distances should be constant and equal to the distance between the instruments. The distances are read on a square stadia rod with figures marked on all four sides, which are consequently always in full view of both observers. This rod is fastened in an upright position on the launch near the leadsman.

All of the soundings were reduced to a common stage of 21.26 feet above the Cairo datum, or 2.19 feet on United States Engineer's gauge at Head of Passes. The depths are entered on the map to the nearest foot.

In the main river above the Head of Passes and throughout Southwest Pass above the mouth of same, curves are drawn at intervals of 5 feet in depth from 20 to 35 feet, inclusive. In the mouth of the pass and across the bar, 5-foot curves are drawn from 10 feet in depth to a depth of 60 feet out in the Gulf of Mexico. The thalweg line is also shown. Where the channel is divided or where isolated pools occur, this line does not always pass through the deepest water of every section, but in such cases is drawn so as to form a smooth flowing line.

The distances in miles, measured along the general axis of the pass, from a point opposite Head of Passes light-house, are indicated on the map. The distance from Head of Passes light-house to crest of bar is 19 miles.

A table of regimen elements has been prepared and is appended, which shows the maximum depth at each section, the width at each section between the banks, and between the curves of equal depth on opposite sides of the pass. It also shows the means of these elements for successive mile intervals.

For a distance of 2 miles from Head of Passes down, the width between banks averages about 1,890 feet; then for 7 miles the width continues quite uniform, ranging from 1,140 to 1,600 feet, and averaging 1,360 feet wide. Beginning with the ninth mile the pass gradually widens out from about 1,400 feet to 4,300 feet at East Point. A few sections opposite outlets show widths as great as 4,900 feet.

From Head of Passes to Pilot Town the distance between the 35-foot curves ranges from 765 feet to 1,600 feet, with an average width of 1,100 feet. Throughout the pass to a point about 3,000 feet below Pilot Town the channel is all that could be wished for.

In the thirteenth mile the 35-foot channel divides and finally ends at a point 8,000 feet below Pilot Town. It begins again at a point about 3 miles below Pilot Town and continues for a distance of about 4,000 feet.

Below this last-named point the channel flattens out toward the crest of the bar, which gives a uniform depth of from 10 to 12 feet for a width of about 5,000 feet. The distance from the lower end of the main 35-foot channel in the pass out to a depth of 35 feet in the Gulf is 30,200 feet, or 5.7 miles.

The distance from the lower end of the lower 35-foot pool to a depth of 35 feet in the Gulf is 16,700 feet, or about 3 miles.

The least thalweg depth between the two 35-foot pools named is 30 feet, and the distance between them is about 9,000 feet.

Table of regimen elements, Southwest Pass, Louisiana.

Number of section.	Distance.	Maximum depth.	Width between banks.	Width between 35-foot curves.	Width between 30-foot curves.	Width between 25-foot curves.	Width between 20-foot curves.
First mile:							
1	....	32–76	3,100	475	525+750	2,500	2,650
2	400	36–52	2,860	560	780+900	2,450	2,525
3 *a*	800	39–61	2,620	545+600	750+1,250	2,330	2,355
4	1,150	41–57	2,400	590+640	795+1,200	2,095	2,120
5	1,535	43–71	2,250	575+780	1,800	1,980	2,015
6	1,920	50–71	2,075	1,420	1,610	1,780	1,815
7	2,360	49–68	1,880	1,320	1,510	1,650	1,680
8	2,770	49–71	1,840	1,275+115	1,475	1,550	1,575
9	3,175	50–75	1,750	1,305	1,460	1,510	1,570
10	3,600	70	1,735	1,230	1,375	1,405	1,425
11	4,010	74	1,715	1,300	1,360	1,385	1,405
12	4,425	70	1,590	1,185	1,315	1,385	1,415
13	4,830	71	1,580	1,235	1,395	1,445	1,460
14	5,250	74	1,580	945	1,305	1,415	1,460
15	5,710	72	1,615	1,100	1,160	1,400	1,435
16	6,200	70	1,620	910	1,275	1,400	1,425
Sums	....	890	32,210	18,100	23,810	27,680	28,330
Means	....	56	2,013	1,131	1,363	1,730	1,770
Second mile:							
17	6,700	67	1,660	975	1,060	1,475	1,545
18	7,200	62	1,715	1,000	1,140	1,530	1,560
19	7,680	56	1,725	1,000	1,200	1,530	1,545
20	8,200	53	1,775	950+125	1,550	1,575	1,595
21	8,700	49	1,760	1,080+310	1,575	1,610	1,660
22	9,225	49	1,810	1,575	1,615	1,645	1,670
23	9,775	46	1,825	1,600	1,645	1,685	1,720
24	10,270	47	1,785	1,520	1,615	1,645	1,660
25	10,800	50	1,850	1,585	1,625	1,660	1,680
26	11,280	61	1,810	1,400	1,505	1,545	1,575
Sums	....	540	17,715	13,120	14,530	15,900	16,210
Means	....	54	1,771	1,312	1,453	1,590	1,621
Third mile:							
27	11,785	66	1,650	1,465	1,475	1,485	1,505
28	12,250	65	1,590	1,425	1,445	1,470	1,480
29	12,780	64	1,500	1,380	1,390	1,405	1,425
30	13,250	61	1,455	1,280	1,300	1,320	1,335
31	13,775	58	1,380	1,230	1,255	1,280	1,305
32	14,275	54	1,385	1,240	1,265	1,295	1,330
33	14,770	52	1,445	1,275	1,295	1,320	1,345
34	15,250	52	1,405	1,200	1,250	1,275	1,300
35	15,725	55	1,425	1,285	1,360	1,380	1,400
36	16,250	57	1,445	1,250	1,330	1,370	1,385
Sums	....	584	14,680	13,030	13,365	13,600	13,810
Means	....	58	1,468	1,303	1,336	1,360	1,381
Fourth mile:							
37	16,730	58	1,460	1,320	1,380	1,415	1,440
38	17,175	64	1,470	125+1,000	1,365	1,430	1,465
39	17,260	61	1,450	150+ 815	1,215	1,310	1,350
40	18,125	66	1,450	50+ 965	1,085	1,130	1,150
41	18,575	75	1,395	45+ 925	1,260	1,285	1,305
42	19,050	74	1,360	175+ 960	1,200	1,215	1,230
43	19,525	73	1,340	1,140	1,160	1,180	1,200
44	20,000	72	1,300	1,070	1,180	1,200	1,220
45	20,480	64	1,220	1,045	1,080	1,110	1,125
46	21,000	65	1,190	1,060	1,080	1,105	1,130
47	21,470	62	1,220	1,040	1,070	1,115	1,160
48	21,960	64	1,200	1,040	1,100	1,125	1,145
Sums	....	798	16,055	12,915	14,165	14,620	14,920
Means	....	66	1,338	1,076	1,180	1,218	1,243
Fifth mile:							
49	22,545	68	1,205	1,015	1,055	1,105	1,125
50	23,050	66	1,225	1,050	1,070	1,110	1,125
51	23,525	74	1,250	1,060	1,080	1,110	1,130
52	24,045	75	1,250	1,050	1,080	1,120	1,140
53	24,475	75	1,250	1,030	1,070	1,110	1,135
54	24,920	75	1,260	1,045	1,085	1,135	1,155
55	25,420	77	1,300	1,025	1,095	1,205	1,225
56	25,925	77	1,320	985	1,080	1,150	1,200
57	26,465	77	1,440	1,070	1,150	1,250	1,295
58	26,970	75	1,425	1,100	1,150	1,265	1,300
Sums	....	734	12,925	10,430	10,915	11,560	11,830
Means	....	73	1,292	1,043	1,091	1,156	1,183

a Head of Passes light.

Table of regimen elements, Southwest Pass, Louisiana—Continued.

Number of sections.	Distance.	Maximum depth.	Width between banks.	Width between 35-foot curves.	Width between 30-foot curves.	Width between 25-foot curves.	Width between 20-foot curves.
Sixth mile:							
59	27,445	73	1,420	1,030	1,125	1,200	1,270
60	28,015	73	1,440	1,100	1,175	1,255	1,300
61	28,545	70	1,390	1,130	1,185	1,230	1,280
62	29,075	69	1,385	1,100	1,175	1,245	1,260
63	29,650	71	1,350	1,090	1,150	1,205	1,265
64	30,100	73	1,330	1,075	1,135	1,175	1,220
65	30,550	72	1,300	1,050	1,125	1,150	1,175
66	31,025	71	1,250	990	1,045	1,100	1,140
67	31,505	66	1,250	1,075	1,100	1,115	1,125
68	32,000	69	1,270	1,100	1,125	1,155	1,190
69	32,500	70	1,370	1,170	1,190	1,225	1,250
Sums		777	14,755	11,910	12,530	13,055	13,475
Means		71	1,341	1,083	1,139	1,187	1,225
Seventh mile:							
70	32,925	71	1,380	1,200	1,245	1,225	1,300
71	33,400	69	1,430	1,075	1,275	1,305	1,335
72	33,800	70	1,475	1,050	1,215	1,300	1,335
73	34,275	74	1,460	1,015	1,095	1,300	1,360
74	34,750	76	1,475	860	1,050	1,215	1,350
75	35,200	84	1,515	850	1,060	1,220	1,320
76	35,620	85	1,500	840	960	1,300	1,365
77	36,125	81	1,490	840	950	1,140	1,275
78	36,620	100	1,500	825	940	1,140	1,260
79	37,125	90	1,500	765	940	1,065	1,250
80	37,600	91	1,525	850	925	1,050	1,160
Sums		891	16,250	10,170	11,655	13,260	14,310
Means		81	1,477	924	1,059	1,205	1,300
Eighth mile:							
81	38,075	93	1,520	870	965	1,045	1,210
82	38,580	92	1,450	915	980	1,075	1,200
83	39,060	86	1,450	930	1,015	1,100	1,170
84	39,525	86	1,450	970	1,060	1,140	1,280
85	40,015	96	1,380	940	975	1,025	1,160
86	40,490	92	1,325	960	1,015	1,085	1,140
87	40,975	77	1,240	975	1,010	1,055	1,105
88	41,475	76	1,215	960	1,020	1,070	1,200
89	41,970	72	1,225	1,050	1,095	1,115	1,130
90	42,475	72	1,210	1,050	1,080	1,105	1,125
91	42,920	70	1,250	1,050	1,070	1,090	1,105
Sums		912	14,715	10,670	11,285	11,905	12,825
Means		83	1,337	970	1,025	1,082	1,166
Ninth mile:							
92*a*	43,450	73	1,265	1,115	1,135	1,170	1,190
93	43,925	75	1,140	1,025	1,045	1,075	1,095
94	44,475	73	1,200	1,035	1,055	1,075	1,095
95	44,925	70	1,225	1,080	1,095	1,120	1,135
96	45,375	74	1,195	1,030	1,060	1,080	1,100
97	45,915	72	1,210	1,035	1,055	1,080	1,105
98	46,290	72	1,225	1,050	1,080	1,120	1,140
99	46,775	75	1,255	1,070	1,100	1,130	1,155
100	47,275	70	1,310	1,115	1,135	1,165	1,180
101	47,775	70	1,325	1,130	1,155	1,190	1,225
102	48,275	68	1,375	1,135	1,180	1,215	1,235
Sums		792	13,725	11,820	12,095	12,420	12,655
Means		72	1,247	1,074	1,099	1,129	1,150
Tenth mile:							
103	48,750	68	1,375	1,160	1,210	1,230	1,250
104	49,250	62	1,375	1,160	1,210	1,230	1,265
105	49,720	60	1,440	1,175	1,230	1,270	1,290
106	50,215	60	1,500	1,190	1,210	1,240	1,310
107	50,710	59	1,555	1,240	1,295	1,360	1,395
108	51,195	58	1,625	1,250	1,350	1,415	1,460
109	51,715	59	1,690	1,270	1,370	1,420	1,455
110	52,200	57	1,750	1,250	1,370	1,470	1,535
111	52,650	57	1,825	1,320	1,430	1,530	1,595
112	53,130	57	1,795	1,320	1,430	1,545	1,585
113	53,605	55	1,840	1,230	1,430	1,575	1,640
Sums		652	17,770	13,565	14,535	15,285	15,780
Means		59	1,615	1,233	1,321	1,362	1,434

a Double Bayou.

Table of regimen elements, Southwest Pass, Louisiana—Continued.

Number of section.	Distance.	Maximum depth.	Width between banks.	Width between 35-foot curves.	Width between 30-foot curves.	Width between 25-foot curves.	Width between 20-foot curves.
Eleventh mile:							
114	54,000	57	1,870	1,225	1,410	1,550	1,640
115	54,620	59	1,880	1,190	1,400	1,540	1,625
116	55,095	59	1,960	1,300	1,505	1,680	1,730
117	55,575	58	1,980	1,090	1,465	1,665	1,760
118	56,070	59	2,045	1,090	1,360	1,580	1,710
119	56,545	59	2,090	1,025	1,400	1,605	1,715
120	57,030	61	2,175	1,080	1,400	1,640	1,805
121	57,525	56	2,200	1,045	1,385	1,580	1,780
122 *a*	58,030	66	2,400	1,020	1,210	1,560	1,775
123	58,850	59	2,395	1,060	1,280	1,625	1,850
Sums	....	593	20,995	11,125	13,815	16,025	17,390
Means	....	59	2,099	1,112	1,381	1,602	1,739
Twelfth mile:	59,025	52	2,395	1,045	1,290	1,585	1,875
124	59,505	54	2,380	1,100	1,385	1,595	1,845
125	60,000	54	2,405	1,015	1,425	1,645	1,945
126	60,470	49	2,395	985	1,345	1,680	1,960
127	60,960	49	2,445	975	1,400	1,695	1,920
128	61,475	52	2,560	1,030	1,455	1,700	2,070
129	61,995	49	2,790	925	1,375	1,700	1,975
130 *b*	62,480	60	2,650	1,200	1,475	1,695	1,970
131	63,000	49	2,625	950	1,450	1,740	2,070
132	63,470	48	2,665	1,000	1,425	1,780	2,165
133	63,940	46	2,790	1,040	1,325	1,830	2,210
134							
Sums	....	562	28,100	11,265	15,350	18,645	22,005
Means	....	51	2,554	1,024	1,395	1,695	2,000
Thirteenth mile:							
135	64,425	43	2,770	1,000	1,310	1,860	2,110
136	64,880	44	2,850	960	1,320	1,940	2,100
137	65,375	42	2,850	930	1,425	1,805	2,120
138	65,875	40	2,940	65+750	1,425	1,950	2,130
139	66,345	40	3,125	50+850	1,340	1,925	2,125
140	66,845	41	3,210	50+845	1,490	1,900	2,150
141	67,330	41	3,290	50+925	1,500	1,900	2,210
142	67,820	41	3,440	40+545	1,350	1,810	2,225
143	68,380	37	3,575	380	1,450	1,875	2,210
144	68,820	38	3,680	140	1,375	1,915	2,300
145	69,285	39	3,820	500	1,350	1,975	2,350
Sums	....	446	35,550	8,080	15,335	20,855	24,030
Means	....	40	3,232	734	1,394	1,896	2,184
Fourteenth mile:							
146	69,785	36	3,810	40+90	1,310	1,900	2,360
147 *c*	70,235	34	4,020	125	1,290	1,940	2,415
148	70,770	33	4,265	....	1,200	1,910	2,440
149	71,260	34	4,575	....	225+760	2,000	2,440
150	71,760	33	4,950	....	310+500	1,890	2,400
151	72,360	31	4,870	....	200+ 95	1,800	2,325
152	72,920	31	4,740	....	50+ 75	1,940	2,375
153	73,350	32	4,640	....	50+75+ 50	2,090	2,400
154	73,715	30	4,475	....	50+ 50	1,950	2,375
155	74,125	31	4,415	....	115+ 50	2,010	2,440
156	74,545	30	3,880	....	150	2,000	2,425
Sums	....	357	48,640	....	6,605	21,430	26,395
Means	....	32	4,422	....	600	1,948	2,399
Fifteenth mile:							
157	75,040	32	3,600	....	250	2,140	2,450
158	75,500	32	3,450	....	325	2,110	2,525
159	76,115	32	3,250	....	40+400	2,000	2,510
160	76,590	32	3,140	....	450	2,050	2,540
161	77,100	31	3,025	....	280+60+70	1,900	2,525
162	77,600	32	3,100	....	150+310+240	1,900	2,310
163	78,100	32	3,150	....	100+140+225	1,875	2,290
164	78,550	32	3,300	....	40+660	1,850	2,225
165	79,025	34	3,250	....	40+70+590	1,800	2,175
166 *d*	79,510	35	3,400	70	90+40+690	1,800	2,200
167	79,975	36	3,525	120	150+550	1,650	2,150
Sums	....	360	36,190	....	5,960	21,075	25,900
Means	....	33	3,290	....	542	1,916	2,354

a Custom-House Bayou.
b Pilot town.
c 35-foot curve ends at 70,360.
d 35-foot curve begins at 79,850.

Table of regimen elements, Southwest Pass, Louisiana—Continued.

Number of section.	Distance.	Maximum depth.	Width between banks.	Width between 35-foot curves.	Width between 30-foot curves.	Width between 25-foot curves.	Width between 20-foot curves.
Sixteenth mile:							
168	80,420	37	3,785	170	776	1,690	2,200
169 *a*	80,920	38	4,825	250	40+570	1,650	2,135
170	81,375	42		200	490	1,650	2,150
171	81,825	38		250	505	1,575	2,150
172	82,330	42		215	451	1,615	2,125
173 *b*	82,800	38		460	725	1,650	2,170
174	83,300	42		250	450	1,485	2,200
175 *c*	83,765	35		40	510	1,350	2,300
176	84,220	34			415	1,000	2,000
177	84,725	32			410	900	2,025
178	85,200	32			325	1,025	1,765
Sums		410		1,835	5,670	15,590	23,220
Means		37		229	515	1,417	2,110
Seventeenth mile:							
179	85,690	31			280	970	1,675
180	86,050	31			150+ 75	950	1,510
181	86,500	30			50+ 40	790	1,450
182 *d*	86,900	28			40+ 40	725	1,375
183	87,375	27				530	1,435
184	87,870	26				240+150	1,475
185 *e*	88,350	24				75	1,525
186	88,800	23					700+560
187	89,275	22					590+520
188	89,725	22					150+225+320
189	90,450	21					255+125+90
Sums		285					13,980
Means		26					1,271

Number of section.	Distance.	Maximum depth.	Width between banks.	Width between 10-foot curves.	Width between 15-foot curves.	Width between 20-foot curves.
Eighteenth mile:						
190	90,890	21		4,600	2,870	150
191 *f*	91,400	20		4,660	2,670	50
192	91,875	18		4,690	2,625	
193	92,425	18		5,185	2,510	
194	92,875	17		4,750	2,425	
195	93,300	16		5,025	1,450+150	
196	93,850	16		5,200	1,550	
197	94,210	16		5,550	475+375	
198 *g*	94,760	15		5,660	60	
199	95,130	15		6,100		
200	95,540	15		6,200		
Sums		187		57,620	17,160	
Means		17		5,238	1,906	
Nineteenth mile:						
201	96,100	15		5,850+425		
202	96,575	14		6,400		
203	97,100	13		6,350		
204 *h*	97,625	13		5,600		
205	98,225	12				
206	98,550	11				
207	99,150	10				
208	99,575	11				
209	100,000	10				
	100,390	15				
	100,450	20				
	100,525	25				
	100,565	30				

a End of shore, East Point.
b Stake Island.
c 35-foot curve ends at 83,810.
d 30-foot curve ends at 86,925.
e 25-foot curve ends at 88,475.
f 20-foot curve ends at 91,450.
g 15-foot curve ends at 94,750.
h 10-foot curve ends at 98,000.

Table of regimen elements, Southwest Pass, Louisiana—Continued.

Number of section.	Distance.	Maximum depth.	Width between banks.	Width between 10-foot curves.	Width between 15-foot curves.	Width between 20-foot curves.
Twentieth mile	100, 590	35	....	....	....	....
	101, 450	40	....	....	....	....
	101, 820	45	....	....	....	....
	102, 200	47	....	....	....	....
	102, 440	53	....	....	....	....
	102, 620	50	....	....	....	....
	103, 075	55	....	....	....	....
	103, 125	60	....	....	....	....
	103, 400	67	....	....	....	....
	103, 740	63	....	....	....	....
	104, 175	77	....	....	....	....
	104, 350	72	....	....	....	....
	104, 800	78	....	....	....	....
	105, 100	82	....	....	....	....
	105, 250	78	....	....	....	....
	105, 850	86	....	....	....	....
	106, 150	92	....	....	....	....
	106, 420	98	....	....	....	....
Twenty-first mile.	106, 575	93	....	....	....	....
	107, 380	100	....	....	....	....

SLOPE GAUGES.

Sixteen staff gauges were set along the left bank of Southwest Pass at intervals of about 1 mile, as follows: One in front of each P. B. M. from 1 to 12 inclusive, one in front of △ Scott's Tower, one in front of sounding flag 148, one at the dock at end of light-house walk on left bank of Light-House Bayou, and one on north side of Stake Island.

These gauges are made of 2 by 4 inch pieces of yellow pine, dressed, painted, and graduated in feet and tenths of a foot, the footmarks being marked by Roman numerals. They are spiked to 4 by 4 inch posts driven where the water is from 2 to 3 feet deep and braced by 2 by 4 inch pieces.

Gauges are set with their zeros at Cairo datum, so their readings give the stages above Cairo datum.

Location of gauge.	Date.	Reading.	Time.
Gauge set in front of—		*Feet.*	
P. B. M. Southwest Pass No. 1	Apr. 9, 1898	23.24	11 a. m.
P. B. M. Southwest Pass No. 2	do	23.08	12 m.
P. B. M. Southwest Pass No. 3	do	22.90	1 p. m.
P. B. M. Southwest Pass No. 4	do	22.60	2 p. m.
Scott's Tower	Apr. 9, 1898	22.45	2.15 p. m.
P. B. M. Southwest Pass No. 5	do	22.22	3.10 p. m.
P. B. M. Southwest Pass No. 6	do	22.15	4 p. m.
P. B. M. Southwest Pass No. 7	Apr. 11, 1898	23.58	12.25 p. m.
P. B. M. Southwest Pass No. 8	do	22.50	1.40 p. m.
P. B. M. Southwest Pass No. 9	do	22.32	2.55 p. m.
P. B. M. Southwest Pass No. 10	do	22.08	4 p. m.
P. B. M. Southwest Pass No. 11	do	21.86	4.35 p. m.
P. B. M. Southwest Pass No. 12	do	21.50	5.45 p. m.
148	Apr. 14, 1898	21.40	8.50 a. m.
Gauge set at dock, Light-house Bayou	do	21.50	11.10 a. m.
Gauge set on north side of Stake Island	do	21.16	10.00 a. m.

On April 16, 1898, readings were taken on all of these gauges between the hours of 2 and 5.11 p. m. to determine the slope.

There was little or no tidal effect during this time, as shown by the hourly and half-hourly readings taken at three different points on the pass and given in the following table:

Tabulation of gauge readings taken to show tidal effect on April 16, 1898.

[Stage at Carrollton=14.6 feet.]

Time.	Reading of gauge at Stake Island.	Reading of gauge at Light-house Bayou.	Reading of gauge at △ Ockerson.
		Feet.	*Feet.*
6.30 a. m		21.05	(a)
7 a. m	20.98	21.08	(a)
7.30 a. m		21.09	(a)
8 a. m	21.01	21.09	(a)
8.30 a. m		21.09	(a)
9 a. m	21.02	21.11	(a)
9.30 a. m		21.11	(a)
10 a. m	21.02	21.12	22.50
10.30 a. m		21.12	22.46
11 a. m	21.02	21.12	22.46
11.30 a. m		21.12	22.49
12 m	21.00	21.11	22.50
12.30 p. m		21.10	
1 p. m	21.00	21.10	
1.30 p. m		21.10	22.47
2 p. m	21.01	21.12	
2.30 p. m		21.13	
3 p. m	21.00	21.12	
3.30 p. m		21.12	
4 p. m	21.03	21.11	
4.10 p. m	21.01		
4.30 p. m		21.12	
5 p. m	21.08	21.14	
5.30 p. m		21.16	
6 p. m	21.09	21.16	
6.30 p. m		21.17	
7 p. m		21.16	
7 a. m to 6 p. m	[b] 21.02	[b] 21.11	

[a] Value of zero unknown. [b] Mean.

Tabulation of gauge readings taken to determine slope of water surface in Southwest Pass on April 16, 1898.

[Stage at Carrollton=14.6 feet.]

Location of gauge.	Distance.	Time.	Reading of gauge.	Slope between successive gauges.	Total slope.
In front of—	*Feet.*		*Feet.*	*Feet.*	*Feet.*
P. B. M., Southwest Pass, No. 1		2.00 p. m.	22.99		
P. B. M., Southwest Pass, No. 2	5,700	2.18 p. m.	22.81	—0.18	—0.18
P. B. M., Southwest Pass, No. 3	11,040	2.35 p. m.	22.68	— .13	— .31
P. B. M., Southwest Pass, No. 4	16,620	2.50 p. m.	22.54	— .14	— .45
△ Scott's Tower	21,870	3.06 p. m.	22.31	— .23	— .68
P. B. M., Southwest Pass, No. 5	27,510	3.25 p. m.	22.26	— .05	— .73
P. B. M., Southwest Pass, No. 6	32,700	3.43 p. m.	22.29	+ .03	— .70
P. B. M., Southwest Pass, No. 7	38,430	3.55 p. m.	22.03	— .26	— .96
P. B. M., Southwest Pass, No. 8	43,070	4.03 p. m.	21.98	— .05	—1.01
P. B. M., Southwest Pass, No. 9	48,360	4.13 p. m.	21.85	— .13	—1.14
P. B. M., Southwest Pass, No. 10	53,600	4.24 p. m.	21.78	— .07	—1.21
P. B. M., Southwest Pass, No. 11	58,500	4.34 p. m.	21.65	— .13	—1.34
P. B. M., Southwest Pass, No. 12	64,140	4.44 p. m.	21.50	— .15	—1.49
Sounding flag 148	68,040	4.55 p. m.	21.43	— .07	—1.56
P. B. M., Southwest Pass, No. 13, Light House Bayou	75,365	5.11 p. m.	21.13	[a] — .30	—1.86
On north side of Stake Island	81,070	2.00 p. m.	21.01	[b] — .12	—1.98

[a] The gauge in Light-House Bayou does not give the slope of the pass proper, as the distance to the Gulf is much shorter through this bayou than through the pass.

[b] Mean of readings taken between 7 a. m. and 6 p. m. gives for the slope between these two gauges —0.09 foot.

NOTE.—The above readings, except at Stake Island, were taken by observer starting from P. B. M., Southwest Pass, No. 1 and rowing downstream in a skiff, stopping at each gauge long enough to get an accurate reading. The conditions for good readings were favorable, there being no wind and little or no tidal effect

Tabulation of gauge readings taken to determine slope of water surface in Southwest Pass on April 17, 1898.

[Stage at Carrollton=14.9 feet.]

Location of gauge.	Time.	Reading of gauge.	Slope between successive gauges.	Total slope.
In front of—		*Feet.*	*Feet.*	*Feet.*
P. B. M., Southwest Pass, No. 1	12.03 p. m.	23.03	....	....
P. B. M., Southwest Pass, No. 2	11.47 a. m.	22.88	—0.17	—0.17
P. B. M., Southwest Pass, No. 3	11.30 a. m.	22.75	— .13	— .30
P. B. M., Southwest Pass, No. 4	11.12 a. m.	22.60	— .15	— .45
△Scott's Tower	10.07 a. m.	22.40	— .20	— .65
P. B. M., Southwest Pass, No. 5	9.50 a. m.	22.38	— .02	— .67
P. B. M., Southwest Pass, No. 6	9.39 a. m.	22.42	+ .04	— .63
P. B. M., Southwest Pass, No. 7	9.20 a. m.	22.10	— .32	— .95
P. B. M., Southwest Pass, No. 8	9.07 a. m.	22.05	— .05	—1.00
P. B. M., Southwest Pass, No. 9	8.55 a. m.	21.97	— .08	—1.08
P. B. M., Southwest Pass, No. 10	8.42 a. m.	21.88	— .09	—1.17
P. B. M., Southwest Pass, No. 11	8.30 a. m.	21.78	— .10	—1.27
P. B. M., Southwest Pass, No. 12	8.20 a. m.	21.61	— .17	—1.44
Sounding flag 148	8.10 a. m.	21.48	— .13	—1.57
P. B. M., Southwest Pass, No. 13, Light-House Bayou	7.50 a. m.	21.21	— .27	—1.84
On north side of Stake Island	....	*a* 21.12	— .09	—1.93

a Estimated by mean difference of readings taken on the 16th of April, as shown by the tabulation.

NOTE.—Most of these readings were taken from steamer *Patrol* while on her way up the pass; the observer standing on the hurricane deck and using binoculars, the steamer being slowed down in front of each gauge. The wind was blowing before the steamer reached the head of the pass, and the readings could not be as accurately estimated as those taken on April 16, and are only considered as a check on those readings.

Tabulation of gauge readings taken to determine slope of water surface in Southwest Pass on May 2, 1898.

[Stage at Carrollton =15.6 feet.]

Location of gauge.	Time.	Reading of gauge.	Slope between successive guages.	Total slope.
In front of—		*Feet.*	*Feet.*	*Feet.*
P. B. M., Southwest Pass, No. 1	6.15 p. m.	23.25	....	....
P. B. M., Southwest Pass, No. 2	6.05 p. m.	23.10	—0.15	—0.15
P. B. M., Southwest Pass, No. 3	5.55 p. m.	22.91	— .19	— .34
P. B. M., Southwest Pass, No. 4	5.45 p. m.	22.78	— .13	— .47
△Scott's Tower	5.35 p. m.	22.49	— .29	— .76
P. B. M., Southwest Pass, No. 5	5.25 p. m.	22.60	+ .11	— .65
P. B. M., Southwest Pass, No. 6	5.15 p. m.	22.52	— .08	— .73
P. B. M., Southwest Pass, No. 7	5.05 p. m.	22.22	— .80	—1.03
P. B. M., Southwest Pass, No. 8	5.00 p. m.	22.15	— .07	—1.10
P. B. M., Southwest Pass, No. 9	4.50 p. m.	22.08	— .07	—1.17
P. B. M., Southwest Pass, No. 10	4.40 p. m.	21.97	— .11	—1.28
P. B. M., Southwest Pass, No. 11	4.30 p. m.	21.80	— .17	—1.45
P. B. M., Southwest Pass, No. 12	4.20 p. m.	21.65	— .15	—1.60
Sounding flag 148	4.10 p. m.	21.55	— .10	—1.70
P. B. M., Southwest Pass, No. 13, Light-House Bayou	3.45 p. m.	21.27	— .28	—1.98
On north side of Stake Island	8.20 p. m.	21.22	— .05	—2.03

NOTE.—The above readings were taken partly from deck of tug *Alert* and partly from skiff, starting from Stake Island and going upstream. The conditions were favorable, there being no wind and little or no tidal effect, the readings being taken within one day of "moon's zero declination."

Tabulation of gauge readings taken to determine slope of water surface in Southwest Pass on July 10, 1898.

[Stage at Carrollton = 6.6 feet.]

Location of gauge.	Time.	Reading of gauge.	Slope between successive gauges.	Total slope.
In front of—		*Feet.*	*Feet.*	*Feet.*
P. B. M., Southwest Pass, No. 1	2.45 p. m.	21.85	....	......
P. B. M., Southwest Pass, No. 2	2.35 p. m.	21.80	—0.05	—0.05
P. B. M., Southwest Pass, No. 3	2.23 p. m.	[a] 21.70	— .10	— .15
P. B. M., Southwest Pass, No. 4	2.12 p. m.	21.66	— .04	— .19
△ Scott's Tower	2.00 p. m.	21.63	— .03	— .22
P. B. M., Southwest Pass, No. 5	1.45 p. m.	21.60	— .03	— .25
P. B. M., Southwest Pass, No. 6	1.35 p. m.	21.45	— .15	— .40
P. B. M., Southwest Pass, No. 7	1.24 p. m.	21.30	— .15	— .55
P. B. M., Southwest Pass, No. 8	1.16 p. m.	21.22	— .08	— .63
P. B. M., Southwest Pass, No. 9	1.07 p. m.	21.20	— .02	— .65
P. B. M., Southwest Pass, No. 10	12.58 p. m.	21.15	— .05	— .70
P. B. M., Southwest Pass, No. 11	12.46 p. m.	21.10	— .05	— .75
P. B. M., Southwest Pass, No. 12	12.39 p. m.	21.03	— .07	— .82
Sounding flag 148	12.31 p. m.	20.97	— .06	— .88
P. B. M., Southwest Pass, No. 13, Light-House Bayou (not read).				
On north side of Stake Island	12.15 p. m.	20.75	— .22	—1.10

[a] Leaning slightly.

NOTE.—The above readings were taken partly from the deck of tug *Alert* and partly from skiff, starting from Stake Island and going upstream. The conditions were favorable, there being no wind and little or no tidal effect, the readings being taken within one day of "moon's zero declination."

Tabulation of gauge readings taken to determine slope of water surface in Southwest Pass on August 19, 1898.

[Stage at Carrollton = 3.9 feet.]

Location of gauge.	Time.	Reading of gauge.	Slope between successive gauges.	Total slope.
In front of—		*Feet.*	*Feet.*	*Feet.*
Head of Passes	1.15 p. m.	22.12	....	......
P. B. M., Southwest Pass, Nos. 1, 2, and 3 (too windy to read).				
P. B. M., Southwest Pass, No. 4	12.05 p. m.	21.97	—0.15	......
△ Scott's Tower	....	....	....	......
P. B. M., Southwest Pass, No. 5	....	....	....	......
P. B. M., Southwest Pass, No. 6	11.45 a. m.	21.82	— .15	—0.30
P. B. M., Southwest Pass, No. 7 (gone).				
P. B. M., Southwest Pass, No. 8	11.35 a. m.	21.70	— .12	— .42
P. B. M., Southwest Pass, No. 9	11.25 a. m.	21.68	— .02	— .44
P. B. M., Southwest Pass, No. 10	11.15 a. m.	21.68	— .00	— .44
P. B. M., Southwest Pass, No. 11	11.05 a. m.	21.60	— .08	— .52
P. B. M., Southwest Pass, No. 12	10.55 a. m.	21.65	+ .05	— .47
Sounding flag 148	10.45 a. m.	21.68	+ .03	— .44
On north side of Stake Island	10.25 a. m.	21.52	— .16	— .60

NOTE.—The above readings were taken partly from the deck of the *Chere Amis* and partly from a skiff, going from Stake Island upstream. Above gauge No. 8 there was too much wind for good reading. There was no tide.

Plate No. 4 shows the slope as deduced on different days and at different stages.

From the tabulation it will be seen that the slope in Southwest Pass varies from something less than 0.6 foot at a stage of 3.9 feet on Carrollton gauge to a little over 2 feet at a stage of 15.6 feet on same gauge.

On June 4, 1898, the Head of Passes gauge read 4.8 feet when Carrollton gauge read 13.7 feet. At 15.3 feet on Carrollton gauge in May, 1898, Head of Passes gauge read 4.9 feet.

During the flood of 1897, when the maximum stage at Carrollton reached 19.2 feet, the stage at Head of Passes was 5.1 feet. The variations noted in stage at Head of Passes could all be accounted for by local influences, such as tides and winds.

It is probable that 2 feet is very near the maximum slope when there is no tidal effect, as the river at Head of Passes and above reaches a general overflow condition at a stage of about 13 feet on Carrollton gauge. This gives a slope of about 0.13 foot per mile at overflow stages.

When the river reaches its lowest stage there is very little if any slope in the pass when there is no tide. At such times the no-slope effect is observed to extend even above New Orleans, and consequently no sand or sediment is brought into the pass by the river. At low tide there would be a slight slope. The slope is modified by the stage of river, and by the temporary stage of the Gulf, which varies even at periods when the tidal effect is at a minimum. The temporary variations in the elevation of the Gulf are due to prevailing winds and distant storms, which drive the waters in or out from the delta coast. As the changes in stage of the river and the Gulf are entirely independent, and may be in the same direction or in opposite directions, the river covering quite a wide range of stage, it follows that there may be an infinite number of conditions, each of which will affect the slope more or less.

It is evident, then, that the question of slope is so complicated by these variable conditions that no definite value can be determined. A long series of observations would, of course, give a mean result that might be of considerable value.

The irregularity in the slope curves at the higher stages, in the vicinity of gauges 5 and 6, were noted in the field, and the elevations of these gauges were redetermined, but no error was found.

The fact that the irregularity largely disappears in the low-stage slopes also suggests that some other explanation must be sought for it.

Among the physical conditions which may tend to produce the abnormal slope may be mentioned the following:

First. The thalweg leaves the left bank and crosses over to the right bank in the vicinity of gauge number 6. It is pushed out from the left bank by the flattening out of the bed, which forms a submerged bar of considerable extent. This abrupt change of direction may cause a local elevation of the water surface, especially on the right bank.

Second. A decrease in the thalweg depth over the crossing.

Third. Decrease in the width of the pass near gauge number 6.

Fourth. An eddy effect along right bank near gauge number 6.

Even taking these conditions into account, the explanation is not wholly satisfactory.

The disbanding of the party before low-stage conditions were reached prevented observations for determining the minimum slopes.

A tide clock established at the lower end of the pass would, in connection with the stage record at the Head of Passes, furnish valuable data for extending the investigation of the changes in the slope.

PROFILE OF SOUTHWEST PASS.

A profile of the pass is appended hereto, plate 2. It extends from a point about a mile above Head of Passes out to deep water in the Gulf. It shows the bottom of the pass on the thalweg line, and consequently the maximum depth. This depth, from Head of Passes to Pilot Town, ranges from 32 feet for a short distance at the upper end to a maximum of 100 feet about halfway down, and an average of 65 feet for the whole distance of 12 miles. The bottom, in the deep water of the pass, seems quite hard.

For a distance of 4 miles below Pilot Town the maximum depth ranges from 30 to 44 feet and averages 35 feet in depth. It then gradually shoals up to a minimum of 10 feet on the crest of the bar. The surface of the bar material is quite soft for a depth of about 2 feet. Below that depth the material is somewhat harder and readily sustains the weight of a man. The thalweg crosses the pass four times, but follows near the right bank three-fourths of the entire distance.

The depth increases from the Head of Passes downstream for a distance of about 7 miles, and then decreases gradually on quite a uniform slope to the crest of the bar.

The Talcott survey gives a maximum depth of 102 feet, an average thalweg depth of 70 feet, and a depth of 48 feet at Head of Passes.

MOVEMENT OF CREST OF BAR AT MOUTH OF SOUTHWEST PASS.

On plate 3 is shown a profile of the thalweg line crossing the bar as derived from surveys made at different times.

The three earlier surveys are reduced from plate 22 of Humphreys and Abbot's report on the Mississippi River. Stake Island is the common initial point of all of these surveys, and the accuracy of the comparisons hinges on the fidelity with which this island has been brought into the several surveys. It is assumed that the relative positions of Stake Island and the crest of the bar are accurately given in the earlier surveys. From these several profiles the advancement of the crest of the bar is found to be as follows:

1838 to 1857 (19 years), 4,540 feet, or 239 feet per annum.
1857 to 1873 (16¾ years), 6,720 feet, or 401 feet per annum.
1873 to 1898 (24¼ years), 4,280 feet, or 176 feet per annum.

In seeking an explanation for the variation in the annual rate of bar advancement it is well to bear in mind that the percentage of flow through the pass has doubtless fluctuated from time to time, owing to the crevasses which have occurred above the Head of Passes and also within its own limits.

The crevasse known as the Jump occurred in 1839, or during the first epoch compared; Cubitts crevasse occurred in 1862, or during the second epoch, and Pass a Loutre occurred in 1891, or during the third epoch. At the time of the last survey all three of these outlets were flowing.

As the percentage of sediment is proportional to the volume, it is evident that the larger the volume the larger the amount of bar material, and consequently a more rapid advancement of the crest may be expected.

The data available pertaining to the earlier surveys are too meager to afford any comparison as to volume of bar deposits. If the deposit for one period is over an area having less depth than the area receiving like deposits at another period of same length, then the first period should show a greater bar advancement. This may account for some of the variations noted.

Perhaps the most decided difference shown in the profiles is in the height of the crests. The survey of 1898 shows a crest which is from 3½ to 5 feet higher than those of previous surveys. These differences are based on the assumption that all depths of the earlier surveys were reduced to mean Gulf level. The data at hand do not show whether this is true or not.

The profiles show that the outer and inner slopes of the bar have changed but little since the date of Howell's survey.

There are not sufficient data to ascertain the amount or nature of the changes which may have occurred in the areas of cross sections.

An examination of the profiles of the bar at different epochs develops the fact that the magnitude of the bar as an obstruction to navigation has not changed materially. The length of bar measured on the line of 35 feet in depth, or the base of the portion projecting above that line, was shorter in 1898 than at any previous date.

Although the crest of the bar has moved out some 15,540 feet since 1838, it has not grown in length, but has traveled by the silt being rolled up the rear slope, to be deposited again on the outer slope. In this way the same bar material may have been moved over and over again many times, while the main body of sediment carried by the waters of the pass has contributed to the elongation and expansion of its banks, the banks of its lateral branches, and the filling up of the adjacent bays. That is to say, the progression of the bar seaward is not necessarily due wholly to the accumulation of silt brought down by the river, but it might still occur to a certain extent after being once formed, even if the river water was devoid of sediment.

These are important factors in any estimates that may be made of the rate of bar advancement after the channel obstruction has been once removed by jetties or otherwise. The neglect of these factors may account for the large discrepancies between the estimated progression and the actual movements as found at South Pass and other similar bars.

DISCHARGE MEASUREMENTS.

On completion of the general survey of Southwest Pass a discharge party was organized to obtain daily discharge measurements of each pass. This party was organized as follows: E. D. Jones in charge; J. W. Skelly, recorder; one leadsman, four boatmen, launch crew of two men, a cook and waiter. They were quartered on the survey boat *Illinois*, which was borrowed, with its equipment, from the Mississippi River Commission. The tug *Alert*, with crew, was hired at New Orleans to use in the discharge work. The party, after securing the necessary supplies, left New Orleans on April 27 and reached Head of Passes on the evening of the same day.

A current meter of the Haskell-Ritchie type had been procured, a reel for operating the same was designed and constructed, and the whole apparatus was tested and put in working order before the main survey party was disbanded. The discharge sections were also selected, the ranges fixed, and some preliminary discharge work was done by the main party. Floats were constructed for use in case of accidents to the current meter and to check the results obtained with the meter. These floats were made of galvanized iron. The subsurface float was simply a hoop 12 inches high and 10 inches in diameter, and provided with a wire bail. The surface float was circular in plan, 13 inches in diameter, elliptical in vertical section, and 3¾ inches high. It was provided with a tube on the upper side in which to insert a small rod bearing a flag.

When in use these floats were connected with a fine cord, the surface float being nearly submerged. In measuring a discharge, the length of connecting cord was adjusted so that the subsurface float would stand at six-tenths of the depth. The floats were then timed over a base line 400 feet long, one float being run from each velocity station.

The Southwest Pass discharge section is located at a point 1,370 meters below Head of Passes light. The South Pass section is 830 meters below the light, and the Pass a Loutre section is 2,640 meters below the head dike, or about 2,550 meters below Head of Passes light.

On the Southwest Pass section there are 11 velocity stations or points at which the velocity of the current is measured. In South Pass there are 7 velocity stations, and in Pass a Loutre 11 stations. This makes the velocity stations in Southwest Pass 150 feet apart, in South Pass 100 feet apart, and in Pass a Loutre 200 feet apart.

In obtaining the velocity with the meter the entire section was first carefully sounded at 50-foot intervals. The tug was then put in position at the velocity station as indicated by the shore ranges. The meter was lowered to a point six-tenths of the distance from the surface of the water to the bottom. When the meter was found to be moving in a satisfactory way the register was started and the record continued for a period of 300 seconds, and from this the velocity per second at each station is deduced. This operation is repeated at each velocity station with as little delay as possible between stations. In this way the discharge of each pass was determined every day when practicable. The work was suspended on August 19.

There were 96 discharge measurements made of Southwest Pass, 82 of Pass a Loutre, and 84 of South Pass. Discharge measurements were also made of the Jump, Cubitts Gap, and Pass a Loutre, below the crevasse.

The discharge of Southwest Pass ranges from 28.8 per cent to 48.1 per cent of the total volume, with an average of 41.4 per cent.

The Pass a Loutre discharge ranges from 45 per cent to 63.2 per cent of the total volume of the river, with an average of 50 per cent. The Pass a Loutre crevasse carries off 38 per cent of the water entering the pass.

The South Pass discharge ranges from 6.8 per cent of the whole volume to 12.4 per cent, with an average of 8.6 per cent. Talcott's survey of 1838 gives these values as 40 per cent, 50 per cent, and 10 per cent, respectively.

The stages at Carrollton when the discharges were determined varied from 15.8 feet down to 2.3 feet.

Cubitts Gap discharges 155,606 cubic feet per second at a stage of 13.3 feet on Carrollton gauge.

The Jump carries off 35,082 cubic feet per second at a stage of 13.3 feet at Carrollton.

A tabulation of the discharge results is appended. These results are also shown graphically on plate 5. In this tabulation the gauge referred to is a local gauge used by the discharge party and set so as to read elevations above Cairo datum. In column giving name of pass the following abbreviations are used: SW. for Southwest Pass, P. a L. for Pass a Loutre, and S. for South Pass. The datum for computing changes in areas of sections is taken at a reading of 21.26 on the local gauge, which is equivalent to mean Gulf level. The mean depth is derived by dividing the area by the width. The difference in the areas of the sections below the datum gives the scour or fill of the sections. The mean velocity per second given in column 11 is deduced by dividing the total discharge by the total area of the section. This total discharge is made up of the discharges of the several partial areas pertaining to each velocity station. The velocity per second at each velocity station is applied to that partial area of the discharge section which lies symmetrically about the velocity station and extends on either side halfway to the next velocity station. The sums of these partial areas and discharges give the totals which are tabulated.

The percentage of discharge deduced from the different passes is deduced on the assumption that the sum of the discharges of all of the passes is equal to the discharge of the main river below Cubitts Gap. The method used in determining the discharge is indicated in column 15, the letter M being used for current meter observations and the letter F for floats.

The direction and force of wind is indicated in the last column. The direction is that which would be indicated on the dial of a watch with the XII upstream. That is, XII would be an upstream wind, VI would be a downstream wind, and other variations would be indicated by the intervening figures.

A study of the discharge results develops the fact that slope is not the controlling function in the matter of velocity. In Southwest Pass, which is 19 miles long from Head of Passes to crest of bar, the velocity at all stages is generally greater, sometimes reaching as high as 45 per cent greater than in South Pass, which is only about 12 miles long, or less than two-thirds of the length of Southwest Pass. This difference may be very largely due to the greater mean depth of the Southwest Pass section, which is nearly double that of the South Pass section.

The observations in Southwest Pass show a range in mean velocity from 4.85 feet down to 0.98 feet per second. In Pass a Loutre there is a range of from 4.72 down to 1.05 feet per second. In South Pass the mean velocity ranges from 4.67 down to 1.05 feet per second.

The maximum velocity observed for a single velocity station is as follows: Southwest Pass, 5.96 feet per second; Pass a Loutre, 6.16 feet per second, and South Pass, 5.80 feet per second. The Talcott survey of 1838 gives the following velocities of the thread of the passes: Southwest Pass, 4.8 feet per second; Pass a Loutre, 3.9 feet per second, and South Pass, 3.3 feet per second.

Velocity measurements were made on the Southwest Pass bar with the following results: May 2, 1898, no tide; inner buoy, depth 18 feet, velocity 3.39 feet per second; middle buoy, depth 15 feet, velocity 4.17 feet per second; outer buoy, depth 11 feet, velocity 3.89 feet per second.

On July 10, 1898, the following results were obtained: Inner buoy, velocity 1.96; middle buoy, velocity at one-third depth 2.13; and outer buoy, velocity at mid depth 2.46 feet per second.

Captain Talcott gives the velocity on the bar as "about 3 feet per second."

In this connection it should be remembered that the stage of river, the direction of the wind, and the tides have great influence on the velocity of the passes. An upstream wind in Southwest Pass will diminish the velocity and discharge in that pass and increase them in the other passes. Corresponding changes will follow other variations of the wind.

The range in volume of discharge was found to be as follows: Southwest Pass, 373,000 down to 75,000 cubic feet per second; Pass a Loutre, 418,000 down to 80,000 cubic feet per second; and South Pass, 76,000 down to 18,000 cubic feet per second. Even smaller values would doubtless be reached at extreme low stages of river.

Some of the more important features of the discharge results are shown graphically in plate 5. This shows the relations between similar elements of the three passes, and also shows the relations between stage and discharge.

The relative percentages of total discharge remain quite constant for all of the passes throughout the season. The velocities and volumes of discharge follow closely the changes in stage of river, and as the minimum stage is approached the volumes of discharge of the different passes become more nearly-equal.

METER RATINGS.

The two wheels belonging to the current meter were rated three different times during the season. These ratings were obtained by drawing the meter through still water at a uniform rate of speed over a measured distance and noting the registrations and time. Different rates of speed gave the registrations for different velocities, and a sufficient range in velocities was determined to cover the range found in actual work. In this way the constants of the meter were well determined. The results of these meter ratings are appended.

Results of discharge observations, passes of Mississippi River, 1898.

[(+) indicates advancing tide and gauge; (—) indicates receding tide and gauge; absence of sign indicates stationary gauge.]

Date.	Name of pass.	Local gauge, Head of Passes.	Cross section of discharge.						Scour or fill (+=scour, —=fill).	Mean velocity per second.	Discharge per second.	Per cent by passes.	Total discharge of river per second.	Method.	Number of velocity stations.	Number of soundings.	Direction and force of wind.
			Area.		Depth.			Width.									
			Water.	Below datum.a	Mean.	Mean datum.	Maximum.										
		Feet.	Sq. feet.	Sq. feet.	Feet.	Feet.	Feet.	Feet.	Sq. feet.	Feet.	Cu. feet.		Cu. feet.				
Apr. 29	SW	+23.58	78,268	74,654	50.2	47.9	78.3	1,623	...	4.844	379,152	...	...	M.	11	...	III, light breeze.
30	SW	+23.59	78,239	74,530	50.1	47.8	76.1	1,623	—124	4.737	370,638	43.5	...	M.	11	...	III, brisk.
30	P. a L.	+23.80	87,446	82,308	43.7	41.2	93.2	2,046	...	4.696	410,667	48.2	...	M.	11	...	VI, light breeze.
30	S	+23.69	17,264	15,714	28.4	26.0	37.5	670	...	4.116	71,070	8.3	852,375	M.	7	...	
May 2	SW	—23.66	77,418	73,592	49.6	47.2	75.9	1,623	— 938	4.807	372,121	...	...	M.	11	...	IV, light breeze.
3	SW	—23.69	76,917	73,048	49.2	46.8	76.0	1,623	— 544	4.847	372,860	...	...	M.	11	...	III, light breeze.
3	S	—23.60	15,935	14,442	26.2	23.9	33.0	670	—1,272	4.321	68,855	...	...	M.	7	...	
4	SW	—23.80	77,562	73,518	49.6	47.1	76.3	1,623	— 470	4.660	361,469	42.5	...	M.	11	...	III, light breeze.
4	P. a L	—23.79	90,849	85,731	45.3	42.8	96.0	2,046	+3,423	4.603	418,144	49.1	...	M.	11	...	V, nearly calm.
4	S	—23.52	15,836	14,394	26.1	23.8	32.3	670	— 48	4.519	71,566	8.4	851,179	M.	7	...	VII, light breeze.
5	SW	23.89	77,745	73,558	49.7	47.1	76.4	1,623	+ 40	4.453	346,166	41.6	...	M.	11	...	III, light breeze.
5	P. a L	—23.84	86,843	81,624	43.4	40.8	95.0	2,046	—4,107	4.721	409,982	49.2	...	M.	11	...	
5	S	—23.52	16,388	14,946	27.0	24.7	33.4	670	+ 552	4.666	76,461	9.2	832,609	M.	7	...	VIII, brisk breeze.
6	SW	+23.95	78,971	74,688	50.6	47.9	77.5	1,623	+1,130	4.163	328,876	...	...	M.	11	...	IX, wind.
6	P. a L	—23.91	88,326	82,965	44.2	41.5	97.0	2,046	+1,341	4.610	407,166	...	...	M.	11	...	II, wind.
7	SW	+23.84	78,764	74,657	50.5	47.9	75.8	1,623	— 31	4.415	347,756	42.5	...	M.	11	...	XII. strong.
7	P. a L	—23.97	94,609	89,127	47.3	44.6	96.4	2,046	+6,162	4.283	405,215	49.5	...	M.	11	...	IV, strong.
7	S	—23.63	14,544	13,032	23.9	21.5	32.4	670	—1,914	4.495	65,381	8.0	818,352	M.	7	...	I, brisk breeze.
9	SW	+23.55	78,525	74,879	50.3	48.0	76.2	1,623	+ 222	4.209	330,483	...	...	M.	11	...	XII, light breeze.
10	SW	+23.50	78,064	74,498	50.0	47.8	76.1	1,623	— 381	4.476	349,444	43.9	...	F.	11	...	III, nearly calm.
10	P. a L	+23.69	88.484	83,568	44.2	41.8	98.7	2,046	—5,559	4.431	392.088	49.2	...	F.	11	...	Calm.
10	S	+23.70	17,719	16,162	29.1	26.7	38.1	670	+3,130	3.122	55,326	6.9	796,858	F.	6	...	Calm, rainy.
11	SW	+23.54	77,093	73,463	49.4	47.1	76.9	1,623	—1,035	4.304	331,803	43.9	...	M.	11	...	II, nearly calm.
11	P. a L	+23.60	87,750	83,016	43.8	41.5	94.5	2,046	— 552	4.189	367,604	48.7	...	M.	11	...	V, light breeze.
11	S	23.67	18,290	16,752	30.1	27.7	38.1	670	+ 590	3.055	55,872	7.4	755,279	M.	7	...	II, nearly calm.
12	SW	+23.34	76,486	73,175	49.0	46.9	76.9	1,623	— 288	4.398	336,354	43.1	...	M.	11	...	XI, light breeze.
12	P. a L	+23.45	86,647	82,245	43.3	41.1	94.5	2,020	— 777	4.416	382,677	49.1	...	M.	11	...	V, light breeze.
12	S	+23.54	18,259	16,804	30.1	27.8	41.0	670	+ 52	3.322	60,651	7.8	779,682	M.	7	...	X, light breeze.
13	SW	+23.19	77,337	74,264	49.5	47.6	75.7	1,623	+1,089	4.401	340,332	44.4	...	M.	11	...	XI, nearly calm.
13	P. a L	+23.34	85,719	81,538	42.9	40.8	93.7	2,020	— 707	4.249	364,102	47.6	...	M.	11	...	III, nearly calm.
13	S	+23.41	17,914	16,542	29.5	27.3	40.2	670	— 262	3.437	61,573	8.0	766,097	M.	7	...	Calm.
14	SW	+23.24	77,680	74,528	49.8	47.8	75.6	1,623	+ 264	4.372	339,630	43.8	...	M.	11	...	Calm.
14	P. a L.	+23.19	86,174	82,295	43.0	41.1	93.5	2,020	+ 757	4.302	370,698	47.8	...	M.	11	...	V, nearly calm.
14	S	+23.20	17,636	16,398	29.0	27.1	41.0	670	— 144	3.684	64,969	8.4	775,297	M.	7	...	Calm.
16	SW	—23.38	76,048	72,668	48.7	46.6	76.9	1,623	—1,860	4.296	326,671	42.9	...	M.	11	...	II, light breeze.

a Datum = 21.26 feet on H. of Passes gauge. Datum widths: S. W. Pass = 1,560 feet; South Pass = 605 feet; Pass a Loutre to June 18 = 2,000 feet; from June 18 = 2,010 feet. See note June 21.

***Results of discharge observations, passes of Mississippi River, 1898*—Continued.**

[(+) indicates advancing tide and gauge; (—) indicates receding tide and gauge; absence of sign indicates stationary gauge.]

Date.	Name of pass.	Local guage, Head of Passes.	Cross section of discharge.						Scour or fill (+=scour, —=fill).	Mean velocity per second.	Discharge per second.	Per cent by passes.	Total discharge of river per second.	Method.	Number of velocity stations.	Number of soundings.	Direction and force of wind.
			Area.		Depth.			Width.									
			Water.	Below datum.a	Mean.	Mean datum.	Maximum.										
		Feet.	Sq. feet.	Sq. feet.	Feet.	Feet.	Feet.	Feet.	Sq. feet.	Feet.	Cu. feet.		Cu. feet.				
May 16	P. a L.	—23.28	85,471	81,411	42.7	40.7	96.3	2,020	— 884	4.260	364,082	47.8	....	M.	11	......	VII, light breeze.
16	S	—23.09	16,426	15,257	27.0	25.2	33.0	673	—1,141	4.287	70,414	9.3	761,167	M.	7	......	VI, light breeze.
17	SW	—23.34	75,178	71,867	48.2	46.1	75.4	1,623	— 801	4.171	313,560	41.9	....	M.	11	......	IV, light breeze.
17	P. a L.	—23.24	88,668	84,688	44.3	42.3	95.3	2,020	+3,277	4.130	366,181	49.0	....	M.	11	......	VIII, light breeze.
17	S	—22.99	16,119	15,014	26.5	24.8	31.8	673	— 243	4.228	68,152	9.1	747,893	M.	7	......	VI, nearly calm.
18	SW	—23.52	75,755	72,157	48.6	46.3	77.4	1,623	+ 290	3.869	293,016	38.7	....	F.	11	......	III, light breeze.
18	P. a L.	—23.41	88,605	84,282	44.3	42.1	92.8	2,020	— 406	4.499	398,656	52.7	....	F.	11	......	V, light breeze.
18	S	—23.00	16,361	15,249	26.9	25.2	30.2	673	+ 235	3.980	65,127	8.6	756.799	F.	7	......	IV, light breeze.
19	SW	—23.67	76,777	72,940	49.2	46.8	75.4	1,623	+ 783	3.730	287,309	40.9	....	M.	11	......	IV, wind.
19	P. a L.	—23.60	88,499	83,797	44.2	41.9	93.2	2,020	— 485	3.969	351,237	50.0	....	M.	11	......	VIII, light breeze.
19	S	—23.29	17,336	16,039	28.5	26.5	33.6	673	+ 790	3.683	63,844	9.1	702,390	M.	7	......	VII, wind, heavy swell.
20	SW	—23.61	76,267	72,546	48.9	46.5	77.5	1,623	— 894	3.827	291,887	41.1	....	M.	11	......	V, wind.
20	P. a L.	—23.57	89,277	84,634	44.6	42.8	93.2	2,020	+ 837	3.951	352,766	49.8	....	M.	11	......	VIII, brisk breeze.
20	S	—23.30	17,350	16,046	28.5	26.5	37.1	673	+ 7	3.716	64,468	9.1	709,121	M.	7	......	V, brisk breeze.
21	SW	—23.56	76,560	72,898	49.0	46.7	75.4	1,623	+ 352	3.753	287,251	39.7	....	F.	11	......	III, brisk breeze.
21	P. a L.	+23.49	88,983	84,501	44.5	42.3	95	2,020	— 133	4.264	379,401	52.4	....	F.	11	......	V, light breeze.
21	S	—23.37	17,401	16,053	28.6	26.5	37.1	673	+ 7	3.291	57,265	7.9	723,917	F.	7	......	Do.
23	SW	+23.43	76,475	73,020	49.0	46.8	77.3	1,623	+ 122	3.770	288,285	42.3	....	M.	11	......	XI, nearly calm.
23	P. a L.	+23.53	88,821	84,258	44.4	42.1	85.7	2,020	— 243	3.777	335,457	49.2	....	M.	11	......	IV, light breeze.
23	S	—23.49	17,631	16,206	29.0	26.8	35.6	673	+ 153	3.292	58,039	8.5	681,781	M.	7	......	VI, light breeze.
24	SW	+23.49	76,966	73,416	49.3	47.1	77.6	1,623	+ 396	3.884	298,950	42.5	....	M.	11	......	XI, nearly calm.
24	P. a L.	23.62	89,238	84,494	44.6	42.2	87.8	2,020	+ 236	3.909	348,810	49.5	....	M.	11	......	IV, light breeze.
24	S	—23.51	17,914	16,476	29.5	27.2	37.3	673	+ 270	3.145	56,336	8.0	704,096	M.	7	......	VI, light breeze.
25	SW	+23.49	75,625	72,075	48.4	46.2	77.7	1,623	—1,341	3.873	292,900	40.0	....	F.	11	......	X, light breeze.
25	P. a L.	23.59	88,484	83,801	44.2	41.9	87.2	2,020	— 693	4.371	386,753	52.9	....	F.	11	......	I, light breeze.
25	S	—23.54	17,616	16,159	29.0	26.7	37.6	673	— 317	2.968	52,285	7.1	731,938	F.	7	......	IX, brisk breeze.
26	SW	+23.43	76,336	72,881	48.9	46.7	77.4	1,623	+ 806	4.046	308,480	43.0	....	M.	11	......	XI, light breeze.
26	P. a L.	+23.54	88,150	83,567	44.1	41.8	87.4	2,020	— 234	4.039	356,057	49.6	....	M.	11	......	II, brisk breeze.
26	S	—23.55	17,597	16,134	29.0	26.7	35.0	673	— 25	3.018	53,103	7.4	718,000	M.	7	......	I, nearly calm.
27	SW	+23.40	74,994	71,587	48.0	45.9	74.8	1,623	—1,294	4.041	303,048	42.8	....	M.	11	......	X, light breeze.
27	P. a L.	+23.50	87,898	83,596	44.0	41.8	90.3	2,020	+ 29	3.986	350,402	49.5	....	M.	11	......	VIII, nearly calm.
27	S	—23.49	18,092	16,667	29.7	27.5	37.0	673	+ 533	3.032	54,854	7.7	708,304	M.	7	......	XI, nearly calm.
28	SW	+23.38	76,019	72,644	48.7	46.6	75.9	1,623	+1,057	4.029	306,280	43.8	....	F.	11	......	XI, nearly calm.
28	P. a L.	23.39	85,169	80,888	42.5	40.4	89.2	2,020	—2,708	4.087	348,116	49.3	....	F.	11	......	XII, nearly calm.
28	S	23.39	17,698	16,337	29.1	27.0	36.7	673	— 330	2.968	52,520	7.4	706,916	F.	7	......	X, light breeze.
31	SW	—23.50	78,390	74,824	50.2	48.0	77.7	1,623	+2,180	3.762	294,896	41.7	....	M.	11	......	V, nearly calm.
31	P. a L.	—23.37	83,970	79,729	41.9	39.8	91.0	2,020	—1,159	4.236	355,679	50.3	....	M.	11	......	I, light breeze.
31	S	—23.16	17,527	16,319	28.9	27.0	35.2	673	— 18	3.252	56,990	8.0	707,565	M.	7	......	V, light breeze.

June	1	SW	—23.58	77,798	74,105	49.8	47.5	77.0	1,623	— 719	3.677	286,085	40.7	....	M.	11	......	Calm.
	1	P. a L.	—23.48	84.504	80,042	42.2	40.0	91.8	2,020	+ 313	4.193	354,286	50.3	....	M.	11	......	V, nearly calm.
	1	S	—22.92	17,475	16,414	28.8	27.1	85.8	673	+ 95	3.627	63,377	9.0	703,748	M.	7	......	IX, nearly calm.
	2	SW	—23.17	77,083	74,042	49.4	47.5	73.1	1,623	— 63	4.315	332,617	44.8	....	M.	11	......	IV, wind, river rough.
	2	P. a L.	—23.77	92,053	87,008	46.0	43.5	90.5	2,020	+6,966	3.752	345,347	46.5	....	M.	11	......	V, light breeze.
	2	S	—23.02	17,614	16,489	29.1	27.3	34.7	673	+ 75	3.683	64,870	8.7	742,834	M.	7	......	VI, wind.
	3	SW	—23.81	78,738	74,678	50.5	47.9	76.8	1,623	+ 636	3.443	271,068	39.2	....	F.	11	......	IV, brisk breeze.
	3	P. a L.	—23.72	91,950	87,005	46.0	43.5	92.5	2,020	— 3	3.913	359,551	52.1	....	F.	11	......	VII, wind.
	3	S	—23.24	17,705	16,440	29.2	27.2	35.2	673	— 49	3.387	59,974	8.7	690,593	F.	7	......	VI, brisk breeze.
	4	SW	—23.83	77,794	73,703	49.8	47.2	76.3	1,623	— 975	3.447	268,161	....	....	M.	11	......	III, light breeze.
	6	SW	+23.65	77,306	73,501	49.5	47.1	76.3	1,623	— 202	3.300	255,146	39.7	....	M.	11	......	XI, light breeze.
	6	P. a L.	—23.85	90,680	85,474	45.3	42.7	91.0	2,020	—1,531	3,667	332,535	51.7	....	M.	11	......	IV, light breeze.
	6	S	—23.54	18,318	16,861	30.2	27.9	38.2	673	+ 421	3.029	55,502	8.6	643,183	M.	7	......	VI, light breeze.
	7	SW	+23.64	78,168	74,379	49.5	47.1	75.1	1,623	+ 878	3.546	277,125	41.8	....	M.	11	......	III, brisk breeze.
	7	P. a L.	23.79	92,150	87,065	46.0	43.5	91.4	2,020	+1,591	3.646	335,903	50.6	....	M.	11	......	VII, light breeze.
	7	S	—23.72	18,224	16,652	30.0	27.5	37.8	673	— 209	2.771	50,499	7.6	663,527	M.	7	......	V, brisk breeze.
	8	SW	+23.45	78,166	74,680	50.0	47.8	73.0	1,623	+ 301	3.676	287,354	42.9	....	F.	11	......	II, brisk breeze.
	8	P. a L.	+23.61	90,892	86,168	45.5	43.1	93.4	2,020	— 897	3.645	331,271	49.5	....	M.	11	......	VII, wind.
	8	S	—23.60	18,052	17,157	30.7	28.4	39.2	673	+ 505	2.705	51,222	7.0	669,847	M.	7	......	V, brisk breeze.
	9	SW	+23.35	77,748	74,421	49.8	47.7	73.8	1,623	— 259	3.690	286,878	42.6	....	M.	11	......	III, brisk breeze.
	9	P. a L.	+23.48	89,884	85,422	44.9	42.7	92.4	2,020	— 746	3.729	335,182	49.8	....	M.	11	......	VI, wind, river rough.
	9	S	23.56	18,253	16,783	30.0	27.7	38.3	673	— 374	2.797	51,062	7.6	673,117	M.	7	......	V, brisk breeze.
	10	SW	+23.34	78,433	75,122	50.3	48.2	75.0	1,623	+ 701	3.737	293,037	43.1	....	M.	11	......	III, brisk breeze.
	10	P. a L.	—23.43	88,745	84,383	44.4	42.2	93.2	2,020	—1,039	3.789	336,295	49.5	....	M.	11	......	IV, nearly calm.
	10	S	—23.36	18,302	16,960	30.1	28.0	37.6	673	+ 177	2.760	50,512	7.4	679,844	M.	7	......	VI, light breeze.
	11	SW	—23.34	78,272	74,961	50.2	48.1	75.1	1,623	— 161	3.808	298,054	43.4	....	M.	11	......	IV, brisk breeze.
	11	P. a L.	—23.28	87,441	83,381	43.7	41.7	92.8	2,020	—1,002	3.880	339,268	49.5	....	M.	11	......	VII, light breeze.
	11	S	—23.34	18,238	16,909	30.1	28.0	38.2	673	— 51	2.678	48,841	7.1	686,163	M.	7	......	VI, light breeze.
	13	SW	—23.37	78,073	74.714	50.0	47.9	73.8	1,623	— 247	3.528	275,419	41.2	....	M.	11	......	IV, light breeze.
	13	P. a L.	—23.16	86,087	83,308	43.1	41.2	90.5	2,020	— 13	3.918	337,832	50.5	....	M.	11	......	VII, light breeze.
	13	S	—22.95	18,164	17,080	29.9	28.2	38.8	673	+ 171	3.039	55,197	8.3	667,948	M.	7	......	VI, light breeze.
	14	SW	—23.35	78,152	74,825	50.1	48.0	73.3	1,623	+ 111	3.371	263,476	41.8	....	F.	11	......	VII, light breeze.
	14	P. a L.	—23.16	85,571	81,752	42.8	40.9	92.8	2,020	—1,616	3.667	313,815	49.7	....	F.	11	......	VIII, light breeze.
	14	S	—22.86	17,850	16,828	29.4	27.8	38.0	673	— 252	2.999	53,530	8.5	630,821	F.	7	......	IX, light breeze.
	15	SW	—23.38	78,116	74,741	50.1	48.0	73.3	1,623	— 84	3.215	251,119	40.9	....	M.	11	......	XII, nearly calm.
	15	P. a L.	—23.24	83,580	79,600	41.8	39.8	73.1	2,020	—2,152	3.691	308,461	50.2	....	M.	11	......	II, light breeze.
	15	S	—22.88	17,838	16,803	29.4	27.8	38.0	673	— 25	3.062	54,623	8.9	614,203	M.	7	......	XI, nearly calm.
	16	SW	—23.42	78,034	74,595	50.0	47.8	72.3	1,623	— 146	3.024	236,011	....	....	M.	11	......	IV, nearly calm.
	17	SW	—23.49	77,631	74,080	49.7	47.5	72.1	1,623	— 515	2.867	222,573	39.7	....	M.	11	......	X, nearly calm.
	17	P. a L.	—23.35	83,074	78,873	41.5	39.4	73.9	2,020	— 727	3.523	292,680	52.1	....	M.	11	......	IX, nearly calm.
	17	S	—23.17	17,889	16,669	29.5	27.6	38.9	673	— 134	2.585	46.244	8.2	561,497	M.	7	......	II, light breeze.
	18	SW	—22.64	76,688	74,497	49.2	47.8	71.9	1,615	+ 417	3.422	262,451	....	....	M.	11	......	VIII, brisk breeze.
	18	S	—22.86	17,753	16,731	29.8	27.7	37.6	673	+ 62	2.811	49,898	....	....	M.	7	......	X, light breeze.
	20	SW	—23.04	77,728	74,894	49.8	48.0	73.6	1,623	+ 397	2.696	209,569	....	....	M.	11	......	VIII, light breeze.
	20	S	—22.74	17,743	16,797	29.3	27.8	37.3	673	+ 66	2.492	44,225	....	....	M.	7	......	III, brisk breeze.
	21	SW	+22.94	77,642	74,974	49.8	48.1	72.4	1,615	+ 80	2.456	190,703	38.9	....	M.	11	......	VIII, light breeze.
	21	P. a L.	—22.57	83,390	80,749	41.5	40.2	83.5	2,031	(*b*)	3.195	266,418	54.3	....	M.	11	......	XI, brisk breeze.
	21	S	+23.04	17,959	16,822	29.6	27.8	38.1	673	+ 25	1.845	33,135	6.8	490,251	M.	7	......	X, brisk breeze.
	22	SW	+22.82	76,972	74,495	49.4	47.8	72.1	1,615	— 479	2.341	180,203	....	....	M.	11	......	VIII, light breeze.

a Datum=21.26 feet on H. of Passes gauge. Datum widths: S. W. Pass=1,560 feet; South Pass=605 feet; Pass a Loutre to June 18=2,000 feet; from June 18=2,010 feet. See note June 21.

b Location of left bank end of section changed June 18. hence new section may not be compared with old.

Results of discharge observations, passes of Mississippi River, 1898—Continued.

[(+) indicates advancing tide and gauge; (—) indicates receding tide and gauge; absence of sign indicates stationary gauge.]

Date.	Name of pass.	Local gauge, Head of Passes.	Cross section of discharge						Scour or fil (+=scour —=fill).	Mean velocity per second.	Discharge per second.	Per cent. by passes.	Total discharge of river per second.	Method.	Number of velocity stations.	Number of soundings.	Direction and force of wind.
			Area.		Depth.			Width.									
			Water.	Below datum.a	Mean.	Mean datum.	Maximum.										
		Feet.	*Sq. feet.*	*Sq. feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Sq. feet.*	*Feet.*	*Cu. feet.*		*Cu. feet.*				
June 23	SW	+22.59	76,658	74,546	49.1	47.8	71.4	1,615	+ 51	2.470	189,329	40.3	....	M.	11	......	IV, nearly calm.
23	P. a L	22.69	84,325	81,440	41.9	40.5	84.5	2,031	+ 691	2.886	243,379	51.8	....	M.	11	......	VIII, light breeze.
23	S	—22.61	17,511	16,678	29.0	27.6	37.5	629	— 144	2.130	37,293	7.9	470,001	M.	7	......	V, brisk breeze.
24	SW	—22.47	76,630	74,718	49.1	47.9	71.9	1,600	— 172	2.721	208,474	43.3	....	M.	11	......	IV, brisk breeze.
24	P. a L	+22.52	84,257	81,711	42.0	40.7	85.8	2,031	+ 271	2.784	234,586	48.7	....	M.	11	......	VIII, brisk breeze.
24	S	—22.51	17,312	16,544	28.6	27.3	36.9	622	— 134	2.236	38,716	8.0	481,776	M.	7	......	V. brisk breeze.
25	SW	+22.49	76,416	74,473	48.9	47.7	71.4	1,600	— 245	2.456	187,652	39.5	....	F.	11	......	IV, light breeze.
25	P. a L	22.52	84,508	81,962	42.1	40.8	85.8	2,031	+ 251	3.019	255,112	53.7	....	F.	11	......	VIII, light breeze.
25	S	—22.50	17,553	16,794	29.0	27.8	37.8	619	+ 250	1.852	32,505	6.8	475,269	F.	7	......	V, light breeze.
27	SW	—22.43	76,457	74,608	49.0	47.8	70.9	1,600	+ 135	2.671	204,222	42.0	....	M.	11	......	IV, brisk breeze.
27	P. a L	—22.34	84,870	82,686	42.2	41.1	85.2	2,034	+ 724	2.706	239,540	49.2	....	M.	11	......	IX, brisk breeze.
27	S	22.17	17,254	16,699	28.5	27.6	36.5	615	— 95	2.489	42,944	8.8	486,706	M.	7	......	V, brisk breeze.
28	SW	—22.45	76,796	74,916	49.2	48.0	71.4	1,600	+ 308	2.697	207,095	41.7	....	M.	11	......	IV, nearly calm.
28	P. a L	—22.28	84,580	82,514	42.1	41.1	85.7	2,033	— 172	2.878	243,435	49.0	....	M.	11	......	VI, light breeze.
28	S	—22.05	17,130	16,649	28.3	27.5	36.9	612	— 50	2.704	46,313	9.3	496,843	M.	7	......	IV, brisk breeze.
29	SW	—22.53	77,167	75,157	49.5	48.2	70.9	1,605	+ 241	2.714	209,453	41.6	....	M.	11	......	III, nearly calm.
29	P. a L	—21.93	83,247	81,890	41.4	40.7	87.5	2,023	— 624	2.961	246,465	49.0	....	M.	11	......	VII, brisk breeze.
29	S	—21.99	17,212	16,770	28.4	27.7	36.9	607	+ 121	2.750	47,329	9.4	503,247	M.	7	......	IV, brisk breeze.
30	SW	—22.75	77,276	74,913	49.5	48.0	71.3	1,612	— 214	2.655	205,166	....	....	M.	11	......	XII, light breeze.
July 1	SW	—22.78	77,187	74,775	49.4	47.9	71.8	1,614	— 138	2.539	195,948	39.7	....	M.	11	......	XII, nearly calm.
1	P. a L	—22.57	84,216	81,565	41.9	40.6	87.8	2,038	— 325	2.961	249,355	50.4	....	M.	11	......	III, brisk breeze.
1	S	—22.07	17,215	16,721	28.4	27.6	36.7	615	— 49	2.845	48,974	9.9	494,277	M.	7	......	Calm to II, light breeze.
2	SW	+22.96	77,729	75,028	49.8	48.1	71.4	1,618	+ 253	2.596	201,783	41.6	....	M.	11	......	Calm to III, brisk breeze.
2	P. a L	—22.84	84,926	81,726	42.3	40.7	87.8	2,040	+ 161	2.829	204,291	49.6	....	M.	11	......	III, light breeze.
2	S	—22.25	17,356	16,751	28.7	27.7	36.4	617	+ 80	2.454	42,600	8.8	484,674	M.	7	......	VI, brisk breeze.
5	SW	22.87	77,276	74,719	49.5	47.9	71.8	1,615	— 309	2.348	181,458	39.3	....	M.	11	......	XII, light breeze.
5	P. a L	—22.36	83,776	81,551	41.7	40.6	87.0	2,036	— 175	2.892	242,247	52.4	....	M.	11	......	Do.
5	S	—22.58	17,783	16,942	29.3	28.0	37.2	669	+ 191	2.159	38,397	8.3	462,102	M.	7	......	X, brisk breeze.
6	SW	+22.67	76,833	74,605	49.2	47.8	70.9	1,600	— 114	2.292	176,071	42.3	....	M.	11	......	IX, light breeze.
6	P. a L	22.77	84,318	81,262	41.9	40.4	87.2	2,038	— 289	2.425	204,491	49.2	....	M.	11	41	XII, light breeze.
6	S	—22.62	17,767	16,901	29.4	28.0	36.8	669	— 41	1.985	35,268	8.5	415,830	M.	7	16	Do.
7	SW	+22.67	76,482	74,207	49.0	47.6	70.6	1,595	— 398	2.382	182,062	42.4	....	F.	11	......	Calm to V, light breeze and rain.
7	P. a L	+22.42	84,222	81,876	41.9	40.7	87.0	2,033	+ 614	2.562	215,814	50.8	....	F.	11	......	X, light breeze.
7	S	—22.37	17,431	16,751	28.8	27.7	36.7	621	— 150	1.793	31,252	7.3	429,128	F.	7	......	IX, brisk breeze.
8	SW	+22.17	76,110	74,681	48.8	47.9	70.2	1,580	+ 474	2.316	176,292	42.0	....	M.	11	......	VIII, nearly calm.
8	P. a L	+22.18	83,655	81,797	41.6	40.7	87.2	2,030	— 79	2.519	210,744	50.2	....	M.	11	......	XII, light breeze.
8	S	—22.20	17,311	16,737	28.6	27.7	37.1	616	— 14	1.906	32,993	7.8	420,029	M.	7	......	I, light breeze.

9........	SW	—22.04	75,944	74,721	48.7	47.9	70.6	1,575	+ 40	2.404	182,576	42.7	....	M.	11	......	VIII, brisk breeze; heavy dead swells.
9........	P. a L...	—22.08	83,975	82,319	41.8	41.0	87.2	2,028	+ 522	2.523	211,845	49.6	....	M.	11	......	XII, brisk breeze.
9........	S	22.07	17,423	16,928	28.8	28.0	37.2	616	+ 191	1.880	32,755	7.7	427,176	M.	7	......	XII, nearly calm.
11........	SW	—22.58	77,418	75,332	49.6	48.3	71.4	1.600	+ 611	2.673	206,966	46.6	....	M.	11	......	XII, wind, river rough.
11........	P. a L...	—22.44	84,434	82,047	42.0	40.8	87.8	2,036	— 272	2.374	200,487	45.2	....	M.	11	......	II, wind, heavy dead swells.
11........	S	—22.25	17,327	16,722	28.6	27.6	36.7	617	— 206	2.094	36,292	8.2	443,745	M.	7	......	XII, wind.
12........	SW	—23.04	77,574	74,749	49.7	47.9	71.9	1,613	— 583	2.551	197,964	43.0	....	M.	11	......	XII, wind, river rough.
12........	P. a L...	—22.87	85,461	82,201	42.5	40.9	87.3	2,040	+ 154	2.625	224,311	48.8	....	M.	11	......	III, wind, river rough.
12........	S	—22.45	17,647	16,918	29.2	28.0	36.9	621	+ 196	2.131	37,598	8.2	459,873	M.	7	......	
13........	SW	—23.07	78,180	75,298	50.1	48.3	72.2	1,623	+ 549	2.209	172,685	39.6	....	M.	11	......	XII, wind.
13........	P. a L...	—22.81	85,442	82,303	42.5	40.9	88.4	2,040	+ 102	2.655	226,834	52.1	....	M.	11	......	I, brisk breeze.
13........	S........	—22.28	17,451	16,827	28.8	27.8	36.8	619	— 91	2.072	36,158	8.8	435,677	M.	7	......	XII, light breeze.
14........	SW	—22.69	77,548	75,279	49.7	48.8	72.2	1,613	— 19	2.266	175,703	41.1	....	M.	11	......	XII, brisk breeze.
14........	P. a L...	—22.44	85,000	82,613	42.8	41.1	87.8	2,035	+ 310	2.520	214,248	50.1	....	M.	11	......	IV, wind, heavy, dead swell.
14........	S........	—22.02	17,315	16,850	28.7	27.9	36.7	619	+ 28	2.160	37,400	8.8	427,351	M.	7	......	III, wind.
15........	SW	—22.97	78,369	75,655	50.2	48.5	72.2	1,613	+ 376	2.149	168,396	40.4	....	M.	11	......	III, brisk breeze.
15........	P. a L...	—22.82	86,515	83,356	43.1	41.5	89.3	2,040	+ 743	2.412	208,633	50.0	....	M.	11	......	VIII, brisk breeze.
15........	S........	—22.29	17,790	17,160	29.4	28.4	37.1	619	+ 310	2.250	40,021	9.6	417,050	M.	7	......	VI, light breeze.
16........	SW	—22.95	78,156	75,474	50.1	48.4	73.0	1,613	— 181	2.032	158,806	40.1	....	M.	11	......	IV, brisk breeze.
16........	P. a L...	-22.88	86,577	83,296	43.0	41.4	87.3	2,040	— 60	2.282	197,577	49.9	....	M.	11	......	IX, brisk breeze.
16........	S........	—22.34	17,609	16,948	29.1	28.0	37.2	619	— 212	2.240	39,458	10.0	395,836	M.	7	......	VI, light breeze.
18........	SW	—22.11	77,212	75,866	49.5	48.6	72.6	1,605	+ 392	2.611	201,676	47.6	....	M.	11	......	VII, nearly calm.
18...... .	P. a L...	—22.77	86,562	83,504	43.0	41.5	88.5	2,040	+ 208	2.204	190,784	45.0	....	M.	11	......	XII, brisk breeze.
18........	S........	—22.61	17,823	16,993	29.5	28.1	37.8	624	+ 45	1.776	31,648	7.4	424,108	M.	7	......	VIII, light breeze.
19........	SW	+22.37	77,370	75,611	49.6	48.5	71.8	1,610	— 255	1.984	153,525	38.7	....	F.	11	......	IV, light breeze.
19...... ..	P. a L ..	—22.30	85,944	83,840	42.7	41.7	88.2	2,035	+ 336	2.444	210,048	52.9	....	F.	11	......	VII, light breeze.
19........	S	—22.00	17,551	17,098	29.0	28.3	37.2	619	+ 105	1.891	33,192	8.4	396,765	F.	7	......	VIII, light breeze.
20........	SW	—22.42	77,246	75,407	49.5	48.3	71.0	1,610	— 204	1.952	150,794	38.1	....	M.	11	......	XI, nearly calm.
20........	P. a L ..	—21.89	84,663	83,391	42.1	41.5	88.0	2,028	— 449	2.473	209,348	52.8	....	M.	11	......	III, nearly calm.
20........	S	—22.15	17,564	17,018	29.0	28.1	37.5	621	— 80	2.050	35,998	9.1	396,140	M.	7	......	IV, nearly calm.
21........	SW.....	+22.27	77,208	75,617	49.5	48.5	71.8	1,590	+ 210	2.013	155,413	40.3	....	M.	11	......	XI, light breeze.
21........	P. a L ..	22.37	84,945	82,701	42.2	41.1	87.8	2,033	— 690	2.317	196,812	51.0	....	M.	11	......	II, brisk breeze.
21........	S	—22.15	17,635	17,089	29.1	28.2	37.7	621	+ 71	1.909	33,660	8.7	385,885	M.	7	......	II, light breeze.
22........	SW.....	+22.13	77,114	75,744	49.5	48.6	71.5	1,590	+ 127	2.100	161,934	43.0	....	M.	11	......	XII, brisk breeze.
22........	P. a L ..	22.17	85,150	83,312	42.3	41.4	87.3	2,030	+ 611	2.157	183,705	48.7	....	M.	11	......	II, brisk breeze.
22........	S	—22.11	17,582	17,062	29.1	28.2	37.3	619	— 27	1.776	31,224	8.3	376,863	M.	7	......	I, light breeze.
23........	SW.....	+22.14	76,763	75,377	49.2	48.3	71.7	1,590	— 367	2.103	161,470	....	....	M.	11	......	X, light breeze.
23........	S	22.17	17,577	17,019	29.0	28.1	37.3	621	— 43	1.533	26,949	....	....	M.	7	......	VI, wind, river rough
25........	SW.....	—21.90	76,839	75,831	49.2	48.6	71.5	1,590	+ 454	2.176	167,227	43.9	....	M.	11	......	VI, light breeze.
25........	P. a L ..	21.67	83,962	83,136	41.8	41.4	89.3	2,020	— 176	2.182	183,208	48.1	....	M.	11	......	IX, brisk breeze.
25........	S	—21.79	17,471	17,147	28.8	28.3	36.8	616	+ 128	1.747	30,524	8.0	380,959	M.	7	......	VIII, light breeze.
26........	SW.....	—21.70	76,546	75,856	49.0	48.6	71.3	1,575	+ 25	2.234	171,016	44.5	....	M.	11	......	VII, light breeze.
26........	P. a L ..	+21.45	83,618	83,236	41.6	41.4	88.7	2,007	+ 100	2.185	182,738	47.5	....	M.	11	......	XI, brisk breeze.
26........	S	—21.57	17,404	17,216	28.8	28.5	87.0	604	+ 69	1.772	30,847	8.0	384,601	M.	7	......	VIII, light breeze.
27........	SW.....	—21.83	76,699	75,801	49.2	48.6	70.5	1,590	— 55	2.109	161,795	44.1	....	M.	11	......	IX, light breeze.
27........	P. a L ..	—21.19	83,178	83,319	41.4	41.5	87.8	2,005	+ 83	2.083	173,229	47.2	....	M.	11	......	XI, brisk breeze.
27........	S	—21.57	17,275	17,086	28.5	28.2	36.9	614	— 130	1.847	31,907	8.7	366,931	M.	7	......	VIII, light breeze.

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a Datum = 21.26 feet on H. of Passes gauge. Datum widths: S. W. Pass = 1,560 feet; South Pass = 605 feet; Pass a Loutre to June 18 = 2,000 feet; from June 18 = 2,010 feet. See note June 21.

Results of discharge observations, passes of Mississippi River, 1898—Continued.

[(+) indicates advancing tide and gauge; (—) indicates receding tide and gauge; absence of sign indicates stationary gauge.]

Date.	Name of pass.	Local gauge, Head of Passes.	Cross section of discharge.						Scour or fill (+=scour, —=fill).	Mean velocity per second.	Discharge per second.	Per cent by passes.	Total discharge of river per second.	Method.	Number of velocity stations.	Number of soundings.	Direction and force of wind.
			Area.		Depth.			Width.									
			Water.	Below datum.a	Mean.	Mean datum.	Maximum.										
		Feet.	*Sq. feet.*	*Sq. feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Sq. feet.*	*Feet.*	*Cu. feet.*		*Cu. feet.*				
July 28	SW	—21.70	76,834	76,000	49.2	48.7	70.7	1,588	+ 199	1.962	150,712	42.0	....	M.	11	......	IV, nearly calm.
28	P. a L	—21.46	83,742	83,339	41.7	41.5	87.8	2,020	+ 20	2.052	171,849	47.8	....	M.	11	......	VIII, light breeze.
28	S	—21.05	16,996	17,122	28.1	28.3	36.0	599	+ 36	2.156	36,644	10.2	359,205	M.	7	......	VII, light breeze.
29	SW	—21.87	76,639	75,679	49.1	48.5	71.4	1,585	— 321	1.894	145,158	....	....	M.	11	......	V, nearly calm.
30	SW	—22.12	77,050	75,691	49.4	48.5	71.4	1,600	+ 12	1.530	117,890	37.3	....	M.	11	......	IX, light breeze.
30	P. a L	—21.73	84,468	83,519	42.0	41.5	88.5	2,030	+ 180	1.893	159,871	50.6	....	M.	11	......	X, brisk breeze.
30	S	—21.05	16,918	17,044	28.0	28.2	36.2	599	— 78	2.241	37,917	12.1	315,678	M.	7	......	VII, light breeze.
Aug. 1	SW	—21.02	74,838	75,212	48.0	48.2	69.9	1,553	— 479	1.358	101,660	48.1	....	M.	11	......	II, light breeze.
1	P. a L	—22.15	84,516	82,715	42.1	41.2	87.7	2,038	— 804	1.050	88,714	41.9	....	M.	11	......	VII, nearly calm.
1	S	—21.39	17,111	17,033	28.3	28.2	36.4	599	— 11	1.232	21,084	10.0	211.458	M.	7	......	V, light breeze.
2	SW	+22.23	76,819	75,286	49.3	48.3	70.3	1,600	+ 74	1.044	80,206	32.9	....	M.	11	......	I, nearly calm.
2	P. a L	22.27	84,859	82,815	42.2	41.2	87.8	2,038	+ 100	1.573	133,454	54.7	....	M.	11	......	IV, nearly calm.
2	S	—21.63	17,295	17,069	28.6	28.2	36.4	614	+ 36	1.756	30,375	12.4	244,035	M.	7	......	I, light breeze.
3	SW	+22.07	76,543	75,266	49.0	48.2	70.4	1,594	— 20	0.981	75,120	28.8	....	M.	11	......	XII, nearly calm, to VII, brisk breeze.
3	P. a L	—21.56	84,106	83,501	41.8	41.5	88.3	2,025	+ 686	1.956	164,485	63.2	....	M.	11	......	X, brisk breeze.
3	S	—21.88	17,402	17,023	28.7	28.1	36.8	619	— 46	1.197	20,823	8.0	260,428	M.	7	......	IX, wind.
4 (a. m)	SW	+21.60	75,720	75,188	48.5	48.2	70.3	1,570	— 78	1.494	113,139	....	....	M.	11	......	V, light breeze.
4 (p. m)	SW	*b*—21.40	75,433	75,214	48.3	48.2	69.2	1,568	+ 26	1.438	108,501	....	....	M.	11	......	Calm.
5	SW	+21.52	75,851	75,444	48.7	48.4	71.0	1,568	+ 230	1.471	111,613	43.3	....	M.	11	......	Calm to X, brisk breeze.
5	P. a L	21.57	83,585	82,959	41.6	41.3	87.8	2,025	— 542	1.536	128,397	49.7	....	M.	11	......	III, brisk breeze.
5	S	21.57	17,316	17,127	28.6	28.3	36.6	614	+ 104	1.048	18,155	7.0	258,165	M.	7	......	I, light breeze.
6	SW	21.42	75,502	75,252	48.4	48.2	70.3	1,565	— 192	1.628	122,949	47.9	....	M.	11	......	X, light breeze.
6	P. a L	+21.48	83,372	82,929	41.5	41.3	87.8	2,018	— 30	1.376	114,734	44.7	....	M.	11	......	VII, wind.
6	S	+21.39	17,081	17,003	28.2	28.1	36.3	601	— 124	1.120	19,138	7.4	256,821	M.	7	......	VI, light breeze.
8	SW	—21.42	75,480	75,230	48.4	48.2	70.2	1,566	— 22	1.574	118,771	40.1	....	M.	11	......	V, light breeze to VIII, brisk breeze.
8	P. a L	—21.17	83,932	84,118	41.7	41.8	87.3	2,018	+1,184	1.803	151,334	51.1	....	M.	11	......	X, brisk breeze.
8	S	—20.99	16,908	17,071	27.9	28.2	36.1	601	+ 68	1.527	25,823	8.8	295,928	M.	7	......	IX, brisk breeze.
9	SW	—21.28	75,683	75,652	48.5	48.5	69.8	1,566	+ 422	1.600	121,066	40.7	....	M.	11	......	VII, brisk breeze, raining, heavy swells.
9	P. a L	—20.88	81,600	82,361	40.6	41.0	87.0	1,993	—1,752	1.771	144,519	48.5	....	M.	11	......	IX, wind.
9	S	—20.90	16,773	16,990	27.7	28.1	35.8	600	— 81	1.915	32,118	10.8	297,703	M.	7	......	IX, brisk breeze.
10	SW	—21.42	75,630	75,380	48.5	48.3	70.1	1,569	— 272	1.360	102,856	35.6	....	M.	11	......	VII, brisk breeze, heavy swells.
10	P. a L	—20.97	82,669	83,250	41.0	41.4	87.5	1,995	+ 889	1.883	155,698	53.9	....	M.	11	......	X, wind.
10	S	—21.34	16,989	16,941	28.1	28.0	36.3	602	— 49	1.771	30,094	10.5	288,647	M.	7	......	VIII, wind, river rough.

11........	SW.....	—21.73	75,989	75,250	48.7	48.2	70.8	1,585	— 180	1.371	104,183	33.1	....	M.	11	......	V, wind, tremendous swells.
11........	P. a L...	—21.45	83,925	83,541	41.8	41.6	88.2	2,025	+ 291	2.088	175,208	55.8	....	M.	11	......	IX, strong wind.
11........	S	—21.13	16,919	16,998	28.0	28.1	36.3	603	+ 57	2.063	34,906	11.1	314,297	M.	7	......	IX, wind, river choppy.
12........	SW.....	—21.82	76,472	75,590	49.1	48.5	70.6	1,590	+ 840	1.664	127,229	39.2	....	M.	11	......	X, light breeze.
12........	P. a L...	—21.51	83,223	82,718	41.5	41.2	87.2	2,030	— 823	1.958	162,921	50.2	....	M.	11	......	XII, light breeze.
12........	S	—20.99	16,973	17,136	28.0	28.8	36.3	605	+ 138	2.030	34,461	10.6	324,611	M.	7	......	VIII, brisk breeze.
13........	SW.....	—21.98	76,443	75,309	49.0	48.3	71.3	1,590	— 281	1.709	130,613	39.6	....	M.	11	......	IV, light breeze.
13........	P. a L...	—21.74	83,471	82,500	41.5	41.0	88.6	2,035	— 218	1.996	166,602	50.5	....	M.	11	......	VII, light breeze.
13........	S	—21.18	17,021	17,069	28.1	28.2	36.7	604	— 67	1.929	32,826	9.9	330,041	M.	7	......	XI, light breeze.
15........	SW.....	—22.15	77,108	75,704	49.4	48.5	70.7	1,595	+ 395	1.683	129,797	39.3	....	M.	11	......	I, light breeze.
15........	P. a L...	—22.03	84,795	83,237	42.2	41.4	88.4	2,038	+ 737	1.937	164,214	49.7	....	M.	11	......	III, light breeze.
15........	S	—21.50	17,094	16,948	28.2	28.0	36.5	609	— 121	2.132	36,450	11.0	330,461	M.	7	......	Do.
16........	SW.....	—22.25	77,312	75,749	49.5	48.5	71.2	1,597	+ 45	1.873	144,775	42.9	....	F.	11	......	II, brisk breeze.
16........	P. a L...	—22.11	84,789	83,069	42.2	41.3	88.8	2,038	— 168	1.882	159,545	47.2	....	F.	11	......	IV, brisk breeze; river rough.
16........	S	—21.72	17,290	17,009	28.6	28.1	36.7	616	+ 61	1.931	33,383	9.9	337,703	F.	7	......	III, light breeze.
17........	S.W....	+22.20	76,930	75,447	49.3	48.4	70.9	1,596	— 302	1.821	140,126	41.4	....	M.	11	......	I, light breeze.
17........	P. a L...	—22.19	85,144	83,262	42.3	41.4	88.2	2,038	+ 193	1.943	165,459	48.9	....	M.	11	......	III, light breeze.
17........	S	—21.90	17,293	16,901	28.5	27.9	37.0	619	— 108	1.895	32,778	9.7	338,363	M.	7	......	I, light breeze.
18........	SW.....	+22.23	76,866	75,385	49.3	48.3	70.1	1,596	— 112	1.673	128,598	41.0	....	M.	11	......	IV, brisk breeze.
18........	P. a L...	—22.25	84,677	82,673	42.1	41.1	88.0	2,038	— 589	1.845	156,200	49.9	....	M.	11	......	VIII, brisk breeze.
18........	S	—22.03	17,369	16,898	28.7	27.9	37.2	619	— 3	1.642	28,513	9.1	313,306	M.	7	......	Do.
19........	SW.....	+22.09	76,609	75,302	49.1	48.3	70.7	1,590	— 33	1.891	144,877	....	....	M.	11	......	, light breeze.

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a Datum=21.26 feet on H. of Passes gauge. Datum widths: S. W. Pass=1,560 feet; South Pass=605 feet; Pass a Loutre to June 18=2,000 feet; from June 18=2,010 feet. See note June 21.

b Local gauge reading for both observations same.

NOTE.—Average of percentages for 80 discharges are as follows: Southwest Pass, 41.4; South Pass, 8.6; Pass a Loutre, 50.

Results of discharge observations.

PASS A LOUTRE BELOW PASS A LOUTRE CREVASSE.

Date.	Name of pass.	Local gauge, Head of Passes.	Cross section of discharge.						Scour or fill (+=scour, −=fill).	Mean velocity per second.	Discharge per second.	Per cent below crevasse.	Total discharge of river per second.	Method.	Number of velocity stations.	Number of soundings.	Direction and force of wind.
			Area.		Depth.			Width.									
			Water.	Below datum.a	Mean.	Mean datum.	Maximum.										
		Feet.	*Sq. feet.*	*Sq. feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Sq. feet.*	*Feet.*	*Cu. feet.*		*Cu. feet.*				
June 2........	....	−23.65	50,444	47,648	48.1	40.7	68.8	1,170	....	4.192	211,459	61.2	345,347	M.	10	......	IX, brisk breeze.
11........	....	−23.27	49,840	47,488	42.6	40.6	72.8	1,170	....	4.222	210,430	62.0	339,268	M.	10	......	VIII, brisk breeze.
18........	....	23.29	51,670	49,295	44.1	42.1	72.1	1,170	....	3.492	180,450	....	....	M.	10	......	III, brisk breeze.
24........	....	+22.47	51,853	49,937	43.9	42.7	72.9	1,170	....	2.977	152,888	65.2	234,586	M.	10	......	VIII, light breeze.
July 9........	....	−22.15	49,398	48,357	42.2	41.3	68.6	1,170	....	2.805	138,564	65.4	211,845	M.	10	......	XII, brisk breeze.
18........	....	+22.79	51,251	49,461	43.8	42.3	70.2	1,170	....	2.244	114,990	60.3	190,784	M.	10	......	XII, light breeze.
Aug. 1........	....	−22.29	50,419	49,209	43.1	42.1	69.7	1,180	....	1.014	51,135	57.6	88,714	M.	10	......	XI, nearly calm.

a Datum = 21.26 feet on Head of Passes gauge; datum width = 1,170 feet; average of percentages, 62.

THE JUMP.

May 9	....	+23.77	12,014	....	....	....	43.2	453	....	2.920	35,062	....	....	M.	7	......	Calm.

CUBITTS GAP.

May 9	....	−23.49	114,094	....	....	....	71.9	3,240	....	1.364	155,606	....	....	M.	13	......	

RATING OF HASKELL METER.

[NOTE.—In the tabulations of meter ratings r = total number of revolutions of meter wheel; t = the total time in seconds in passing over the base; x = the number of revolutions per second; y = the speed in feet per second; x_o and y_o are the means, respectively, of x and y; a and b are constants which may be derived from the general formula y = ax + b.]

Rating of Haskell meter in Company Canal, New Orleans, La., April 25, 1898.

[Wheel I. Length of base, 200 feet. E. D. Jones, observer; J. W. Skelly, recorder.]

No.	r	t	x	y	$x-x_o$	$y-y_o$	$(x-x_o)^2$	$(x-x_o)(y-y_o)$
2	94	95.4	0.985	2.096	−1.126	−2.194	1.268	2.470
4	93	85.5	1.088	2.339	−1.023	−1.951	1.047	1.996
6	93	72.2	1.288	2.770	− .823	−1.520	.677	1.251
7	99	25.2	3.929	7.936	+1.818	+3.646	3.305	6.628
8	92	125.8	.731	1.590	−1.380	−2.700	1.904	3.726
12	100	38.2	2.618	5.236	+ .507	+ .946	.257	.480
13	99	53.8	1.840	3.717	− .271	− .573	.073	.155
14	101	38.25	2.641	5.229	+ .530	+ .939	.281	.498
15	99	58	1.707	3.448	− .404	− .842	.163	.340
16	99	30.9	3.204	6.472	+1.093	+2.182	1.195	2.385
17	99	51.4	1.926	3.891	− .185	− .399	.034	.074
18	98	24	4.083	8.333	+1.972	+4.043	3.889	7.973
19	98	58	1.690	3.448	− .421	− .842	.177	.354
20	99	31	3.194	6.452	+1.083	+2.102	1.173	2.341
21	99	61.5	1.610	3.252	− .501	−1.038	.251	.520
23	99	57	1.737	3.509	− .374	− .781	.140	.292
25	99	58.2	1.701	3.436	− .410	− .854	.168	.350
27	98	56.8	1.725	3.521	− .386	− .769	.149	.297
28	100	45.4	2.203	4.405	+ .092	+ .115	.008	.011
29	99	57.9	1.710	3.454	− .401	− .836	.161	.335
30	100	34.8	2.874	5.747	+ .763	+1.457	.582	1.112
31	92	133.25	.690	1.501	−1.421	−2.779	2.019	3.949
32	98	29	3.379	6.897	+1.268	+2.607	1.608	3.306
Sums	....	....	48.553	96.679	....	....	20.529	40.843
Means	....	....	2.111	4.200	....	....	....	....

$(x-x_o)^2\,a - (y-y_o)(x-x_o) = 0.$ $a = 1.9875$; $b = y_o - ax_o$; $b = +0.0902.$

The meter was suspended from bow of a small skiff by a half-inch line, at depth of 2½ feet. The skiff was pulled forward by line drawn by men on the bank; backward, by oarsmen rowing with a speed as nearly uniform as possible. This rating was used in computing the first discharges, and was discontinued on the following dates, and the rating of June 8 substituted thereafter: In Southwest Pass, May 7; in Pass a Loutre, May 6; in South Pass, May 6.

Rating of Haskell meter in Red Pass (near Jump) June 4, 1898.

[Wheel I. Length of base, 200 feet. E. D. Jones, observer; J. W. Skelly, recorder.]

No.	r	t	x	y	$x-x_o$	$y-y_o$	$(x-x_o)^2$	$(x-x_o)(y-y_o)$
1	99	40	2.475	5	+0.554	+1.059	0.307	0.587
2	97	68.5	1.416	2.920	− .505	−1.021	.255	.516
3	99	39	2.538	5.128	+ .617	+1.187	.381	.732
4	98	66	1.485	3.030	− .436	− .911	.190	.397
5	99	31.8	3.113	6.289	+1.192	+2.348	1.421	2.799
6	99	65	1.523	3.077	− .398	− .864	.158	.344
7	99	89	1.112	2.247	− .809	−1.694	.654	1.370
8	98	96.3	1.018	2.077	− .903	−1.864	.815	1.683
9	98	37.5	2.613	5.333	+ .692	+1.392	.479	.963
10	75	166.3	.451	1.203	−1.470	−2.738	2.161	4.025
11	99	39.8	2.487	5.025	+ .566	+1.084	.320	.614
12	73	372	.196	.538	−1.725	−3.403	2.976	5.870
13	99	48.7	2.033	4.107	+ .112	+ .166	.012	.019
14	99	43.6	2.271	4.587	+ .350	+ .646	.122	.226
15	97	39.8	2.437	5.025	+ .516	+1.084	.266	.559
16	98	31.9	3.072	6.270	+1.151	+2.329	1.325	2.681
17	98	29.3	3.345	6.826	+1.424	+2.885	2.028	4.108
18	98	29.7	3.300	6.734	+1.379	+2.793	1.902	3.852
19	97	55.4	1.751	3.610	− .170	− .331	.029	.056
20	97	71.4	1.359	2.801	− .562	−1.140	.316	.641
21	98	25	3.920	8	+1.999	+4.059	3.996	8.114
22	95	88.5	1.073	2.260	− .848	−1.681	.719	1.425
23	89	135	.659	1.481	−1.262	−2.460	1.593	3.105
24	97	40.2	2.413	4.975	+ .492	+1.034	.242	.509
25	98	47.7	2.055	4.193	+ .134	+ .252	.018	.034
26	98	59.6	1.644	3.356	− .277	− .585	.077	.162

Rating of Haskell meter in Red Pass (near Jump) June 4, 1898—Continued.

No.	r	t	x	y	x—x₀	y—y₀	(x—x₀)²	(x—x₀)(y—y₀)
27	78	189.3	.412	1.057	—1.509	—2.884	2.277	4.352
28	98	49.4	1.984	4.049	+ .063	+ .108	.004	.007
29	99	39.8	2.487	5.025	+ .566	+1.084	.320	.614
30	87	181	.481	1.105	—1.440	—2.836	2.074	4.084
31	99	40	2.475	5	+ .554	+1.059	.307	.587
32	99	33.9	2.920	5.900	+ .999	+1.959	.998	1.957
33	95	63	1.508	3.175	— .413	— .766	.171	.316
34	95	95	1	2.105	— .921	—1.836	.848	1.691
35	97	80	1.212	2.500	— .709	—1.441	.503	1.022
36	96	89.2	1.076	2.242	— .845	—1.699	.714	1.436
37	99	26.4	3.750	7.576	+1.829	+3.635	3.345	6.648
Sums	....	....	71.064	145.826	....	....	34.323	68.105
Means	....	....	1.921	3.941	....	....	....	....

$$(x-x_0)^2 a-(y-y_0)(x-x_0)=0; \quad a=1.9558; \quad b=y_0-ax_0; \quad b=0.1839.$$

Meter was suspended from bow of skiff by half-inch line at depth of 2½ feet below the surface. Skiff was drawn forward by line pulled by men on bank, and backward by oarsmen rowing with a speed as nearly uniform as possible. This rating was used in discharges beginning as follows: Southwest Pass, May 9; Pass a Loutre, May 7; South Pass, May 7; and was used until Wheel II was substituted on the following dates: In Southwest Pass, July 8; in Pass a Loutre, July 6; in South Pass, July 6. Wheel II was used without intermission thereafter until the end of the work.

Rating of Haskell meter in Red Pass, Venice, La., June 30, 1898.

[Wheel I. Length of base, 200 feet. E. D. Jones, observer; J. W. Skelly, recorder.]

No.	r	t	x	y	x—x₀	y—y₀	(x—x₀)²	(x—x₀)(y—y₀)
1	100	38	2.632	5.263	+1.307	+2.563	1.708	3.350
2	99	83.3	1.188	2.401	— .137	— .299	.019	.041
3	95	120.7	.787	1.657	— .538	—1.043	.289	.561
4	99	52.7	1.878	3.795	+ .553	+1.095	.306	.606
5	87	177.8	.489	1.125	— .836	—1.575	.699	1.317
6	98	86.3	1.136	2.317	— .189	— .383	.036	.072
7	96	120.2	.799	1.664	— .526	—1.036	.277	.545
8	96	118.5	.810	1.688	— .515	—1.012	.265	.521
9	96	94	1.021	2.128	— .304	— .572	.092	.174
10	97	87.4	1.110	2.288	— .215	— .412	.046	.089
11	98	75	1.306	2.667	— .019	— .033	.000	.001
12	100	58.8	1.701	3.401	+ .376	+ .701	.141	.264
13	99	58.8	1.684	3.401	+ .359	+ .701	.129	.252
14	101	41.7	2.422	4.796	+1.097	+2.096	1.203	2.299
15	91	167.7	.543	1.193	— .782	—1.507	.612	1.178
16	98	102.2	.959	1.957	— .366	— .743	.134	.272
17	95	105.7	.899	1.892	— .426	— .808	.181	.344
18	99	67	1.478	2.985	+ .153	+ .285	.023	.044
19	95	129.3	.735	1.547	— .590	—1.153	.348	.680
20	100	51.3	1.949	3.899	+ .624	+1.199	.389	.748
21	98	81.8	1.198	2.445	— .127	— .255	.016	.032
22	100	42.4	2.359	4.717	+1.034	+2.017	1.069	2.086
23	94	108.2	.869	1.848	— .456	— .852	.208	.389
24	97	99.3	.977	2.014	— .348	— .686	.121	.239
25	70	271.3	.258	.737	—1.067	—1.963	1.138	2.094
26	101	38.3	2.637	5.222	+1.212	+2.522	1.469	3.057
27	99	63.9	1.549	3.130	+ .324	+ .430	.105	.139
28	98	125	.784	1.600	— .541	—1.100	.293	.595
29	99	45.5	2.176	4.396	+ .851	+1.696	.724	1.443
30	101	56.2	1,797	3.559	+ .472	+ .859	.223	.405
31	95	100.8	.942	1.984	— .383	— .716	.147	.274
Sums	....	....	41.072	83.716	....	....	12.410	24.111
Means	....	....	1.325	2.700	....	....	....	....

$$a=\frac{(x-x_0)(y-y_0)}{(x-x_0)^2}=1.9439; \quad b=y_0-ax_0=0.1257.$$

Meter was suspended from bow of skiff by ⅜-inch lead line at depth of 2 feet. The observations were made by drawing the skiff forward and backward through the water, forward, by men pulling ½-inch line attached to bow. An anchor with pulley attached was buried in the bottom at farther end of base, and a line was run through pulley and attached to stern of skiff. This line leading out on the bank at a right angle to the base, when drawn by two other men, gave the backward observations. This rating was not used in the computations.

38	157	48.8	3.217	4.098	+ .917	+1.193	.841	1.094	+1.150	− .043	.003	10.24
39	157	111.8	1.404	1.789	− .896	−1.116	.808	1.000	−1.124	− .008	.000	1.96
40	161	36	4.472	5.556	+2.172	+2.651	4.718	5.758	+2.724	+ .073	.005	20.25
Sums			91.982	116.203			52.875	66.308			.096	262.50
Means			2.300	2.905								

$\frac{(y-y_o)\,(x-x_o)}{(x-x_o)^2}=a=1.2541$; $y_o-ax_o=b=0.0206$; $p_a=52.875$; $p_b=8.06$; $e=\pm .05$; $e_a=\pm 0.0069$; $e_b=\pm 0.0176$.

Meter suspended from bow of skiff by ½-inch line, at depth of 4½ feet. Methods of observation same as on June 30, 1898, except that an anchor with pulley attached was buried at each end of course; but a better and deeper point in the pass was selected, the water here being from 6 to 8 feet deep.

Rating of Haskell meter in Red Pass, Venice, La., August 19, 1898.

[Wheel II. Length of base, 200 feet. J. W. Skelly, observer.]

No.	r	t	x	y	x—x₀	y—y₀	(x—x₀)²	(x—x₀)(y—y₀)	(x—x₀)a	v	vv	x²
1	155	74.6	2.078	2.681	+0.703	+0.912	0.494	0.641	+0.856	—0.056	0.0081	4.41
2	164	46.7	3.512	4.283	+2.137	+2.514	4.567	5.372	+2.601	+ .087	.0076	12.25
3	148	108.6	1.363	1.842	— .012	+ .073	.000	.001	— .015	— .088	.0077	1.96
4	164	55.4	2.960	3.610	+1.585	+1.841	2.512	2.918	+1.929	+ .088	.0077	9
5	157	72.3	2.171	2.766	+ .796	+ .997	.634	.794	+ .969	— .028	.0008	4.84
6	154	85.5	1.801	2.339	+ .426	+ .570	.181	.243	+ .518	— .052	.0027	3.24
7	155	118	1.314	1.695	— .061	— .074	.004	.005	— .074	.000	.0000	1.69
8	156	98.8	1.579	2.024	+ .204	+ .255	.042	.052	+ .248	— .007	.0000	2.56
9	153	149	1.027	1.342	— .348	— .427	.121	.149	— .424	+ .003	.0000	1
10	150	136.5	1.099	1.465	— .276	— .304	.076	.084	— .336	— .032	.0010	1.21
11	149	143.2	1.041	1.397	— .334	— .372	.112	.124	— .406	— .034	.0012	1
12	167	267.2	.625	.749	— .750	—1.020	.563	.765	— .913	+ .107	.0114	.36
13	150	179.2	.837	1.116	— .538	— .653	.289	.351	— .655	— .002	.0000	.64
14	163	136.5	1.194	1.465	— .181	— .304	.033	.055	— .220	+ .084	.0071	1.44
15	147	191	.770	1.047	— .605	— .722	.366	.437	— .736	— .014	.0002	.64
16	143	169	.846	1.183	— .529	— .586	.280	.310	— .644	— .058	.0034	.64
18	141	191.2	.737	1.046	— .638	— .723	.407	.461	— .776	— .053	.0028	.49
19	160	149.7	1.069	1.336	— .306	— .433	.094	.132	— .372	+ .061	.0037	1.21
20	181	283	.463	.707	— .912	—1.062	.832	.969	—1.110	— .048	.0023	.25
21	160	109	1.468	1.835	+ .093	+ .066	.009	.006	+ .113	+ .047	.0022	2.25
22	112	341	.328	.587	—1.047	—1.182	1.096	1.238	—1.274	— .092	.0085	.09
23	156	44.5	3.506	4.494	+2.131	+2.725	4.541	5.807	+2.593	— .132	.0174	12.25
24	129	322.3	.400	.621	— .975	—1.148	.951	1.119	—1.187	— .039	.0015	.16
25	157	60.4	2.599	3.311	+1.224	+1.542	1.498	1.887	+1.490	— .052	.0027	6.76
27	156	106.4	1.466	1.879	+ .091	+ .110	.008	.010	+ .111	+ .001	.0000	2.25
28	153	143.3	1.068	1.396	— .307	— .373	.094	.115	— .374	— .001	.0000	1.21
29	154	134	1.149	1.493	— .226	— .276	.051	.062	— .275	+ .001	.0000	1.21
30	164	171.3	.957	1.168	— .418	— .601	.175	.251	— .509	+ .092	.0085	1
31	150	192.6	.779	1.038	— .596	— .731	.355	.436	— .725	+ .006	.0000	.64
32	164	138.7	1.182	1.442	— .193	— .327	.037	.063	— .235	+ .092	.0085	1.44
33	153	163.5	.936	1.223	— .439	— .546	.193	.240	— .534	+ .012	.0001	.81
34	163	113.8	1.439	1.765	+ .064	— .004	.004	.000	+ .078	+ .082	.0067	1.96
35	158	98.8	1.599	2.024	+ .224	+ .255	.050	.057	+ .273	+ .018	.0003	2.56
Sums	....	....	45.362	58.369	....	....	20.669	25.152	....	....	.1191	83.42
Mean	....	....	1.375	1.769	....	....	....	....	....	....	....	....

$\frac{(x-x_0)\ (y-y_0)}{(x-x_0)^2}=a=1.2169$; $y_0=ax_0=b=0.0958$; $p_a=20.669$; $p_b=8.18$; $e=\pm 0.062$; $e_a=\pm 0.0136$; $e_b=\pm 0.0217$.

Conditions and methods of observation identical with those of July 29, 1898.

Rating derived from three sets of observations.

[This rating was used for all discharges taken with Wheel II.]

Rating.	a	b	e_a^{-2}	$a e_a^{-2}$	e_b^{-2}	$b e_b^{-2}$
1898.						
June 30	1.2298	0.0909	33,222.6	40,857.2	5,988	544.3
July 29	1.2541	.0206	21,141.6	26,513.7	3,225.8	66.5
August 19	1.2169	.0958	5,376.3	6,542.4	2,127.7	203.8
Summations	....	....	59,740.5	73,913.3	11,341.5	814.6

$a_0 = 1.2372$; $b_0 = 0.0718$.

The discharge work was suspended on August 20, as the low stage of river had been reached, and the allotment of funds was not sufficient to carry on the work through the rising phase to the next maximum.

The meter and appurtenances were turned over to Asst. Engineer C. Donovan, at Port Eads, and the party proceeded to New Orleans, arriving there on August 23 with the tug *Alert* and survey boat *Illinois*. The party was disbanded on the same day, and the *Alert* was turned over to her owners. A watchman was retained on the *Illinois* until she was delivered to the Mississippi River Commission at New Madrid, Mo., on September 9, 1898.

NOTEBOOKS.

The notes of the survey are entered in the following notebooks:

Journal of main survey party, No. 1	1
Angles read in triangulation, No. 2	1
Precise levels, Nos. 3, 4, 5	3
Angles, etc., locating soundings, Nos. 6, 7, 8, 9	4
Soundings, Nos. 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	10
Topography, Nos. 20, 21, 22	3
Discharge work, Nos. 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33	11
Total	33

THE MAP.

A map has been prepared covering the whole survey from Pilot Station above Head of Passes out to a depth of 100 feet in the Gulf of Mexico. It is in one sheet, on a scale of 1 to 4,800.

This map has been traced in five sections, and these traced sections have been blue printed for the use of the Board, leaving the finished map to accompany the report of the Board and to be used for reproduction if deemed advisable.

A map has also been prepared on a scale of 1:10,000, which shows the mouth of the pass from Pilot Town down, and also all soundings taken along the bar on each side of the pass proper. This has also been traced and blue printed for the use of the Board.

It is believed that these maps and other data herewith fully cover the physical features of the Southwest Pass, and it is hoped that they will satisfactorily meet the requirements of the Board.

In closing I wish to acknowledge the faithful assistance of all who have been engaged with me in the field work and reduction of the notes of the survey. Their work was often done under difficult and disagreeable conditions. Their energy and efficiency made it possible to complete the very large amount of field work comprising the general survey of the pass in the brief space of one month.

I am also indebted to Capt. H. E. Waterman, secretary of the Mississippi River Commission, for courtesies extended in the way of office facilities, which expedited very materially the reduction of notes and mapping.

Very respectfully, your obedient servant,

J. A. Ockerson,
Assistant Engineer.

Maj. James B. Quinn,
Member Board of Engineers, New Orleans, La.

C.

HISTORY OF ATTEMPTED IMPROVEMENTS OF THE MOUTH OF THE MISSISSIPPI RIVER, BY MAJ. JAMES B. QUINN, CORPS OF ENGINEERS.

Standing upon the bank of the Mississippi River at New Orleans one is impressed with the vastness of its flood and the presumptively great periods of time covered by the progress of the delta which characterizes its issue into the Gulf of Mexico. To what races of men has its existence been known? Our acquaintance does not cover many years, it is true, but the natives who occupied the land before the advent of the white man point to the various mounds of earth which are found at numerous places throughout southern Louisiana as the constructions of a race extinct for so great a time that among them there exists no traditions concerning this race of people who have disappeared, and who must have possessed some degree of civilization, as the pottery, relics, and stone implements found in the mounds bear witness.

It is reasonable to suppose that at some distant time in the past the mouth of the river was in the immediate vicinity of New Orleans, yet to-day it is fully 112 miles by river to the sea, and fully 45 miles below New Orleans an Indian mound exists, which must certainly have been built some distance from the mouth, if the marshy and low condition of the land existed then, as now, in that vicinity.

There is one remarkable circumstance connected with the flow of the river, and that is the persistency with which it adheres to the channel which it has scoured out for itself. Crevasses occur in its banks, and the volume of water escaping is sufficient to cause one, for the time, to believe that the river has changed its course; but in time the crevasse ceases to be other than an insignificant stream or ceases to flow entirely. Although the river may change the location of its bed sometimes by cutting out upon one side and filling in upon the other, or cutting through bends and forming cut-offs, the continuity of the stream is rarely interrupted. Such interruptions have, however, occurred in modern times, as in the vicinity of New Madrid, where the channel was changed by reason of an earthquake; and the peculiar bends at what is known as English Turn, below New Orleans a short distance, when taken into consideration with the peculiar formation of the land between Lake Borgne and Chandeleur Sound, might lead to the inference that at some time the mouth was not far from the Chandeleur Island, and that the present channel was created through the action of some earthquake, which forced the stream to the westward for a short distance and then permitted it to erode or create the channel which it now pursues.

There are not lacking evidences of seismic action within the limits of the city of New Orleans, since recent excavations have brought to light the stumps of cypress trees which at one time stood in fresh-water swamps above the level of the Gulf, but which are now as much as 14 feet below this level, their preservation and general appearance indicating a sudden subsidence.

Some influences are always at work to direct the course of the river in building the earthen trough which forms its channel. The water is at times heavily charged with sediment, and this sediment is borne along with the current or abandoned in part as the current slackens; but in the end it finds a resting place in the swamp bordering the stream, where the banks are not high enough to prevent overflow, or it is dropped near the point where the river water meets the sea water and builds up at this place a bar, the depth of water upon which is invariably slight compared with the depths in the main body of the river.

The manner in which these bars form and extend influences the general direction which the main body of the river ultimately pursues. Invariably numerous branches form in the immediate vicinity of the mouth. These branches are known as "passes," and spread out like the fingers of the hand when distended. Each of these branches performs its office of filling in the watery spaces on either hand, and they advance, or silt up, as the conditions of the river at the point whence they ramify changes. The area included in their ramifications is called the "Delta," and this formation is characteristic of all silt-bearing streams which debouch into seas.

To-day three passes branch from the main body of the river and form an extensive delta; yet if you retrace your steps along the bank of the river to New Orleans you will probably not be able to discover any points, except such as have formed in recent times, where you would be certain that a delta existed at any time. Is it possible that this river in its youth flowed into the sea without a delta? If so, it must have been a vigorous stream compared with what it is to-day.

The first pass which is noted as giving proper depth over its bar for the passage of vessels was Southeast Pass, which is now a very insignificant pass indeed. Then navigation, after a time, deserted this pass and sought other passes, as Pass a Loutre and Southwest Pass, at which passes there seemed to be alternations of favor, as their bars deepened or shoaled. With increasing needs for greater depths of water, efforts were made to improve these passes; and, first, there was tried the method of stirring up the bottom with harrows, which was moderately successful in securing a slight increase. Then an attempt was made to combine jetties with the stirring-up process. This failed, for the reason that the jetties were entirely too frail, and did not extend far enough to produce much effect. During all this time the necessities of commerce grew with far greater strides than the efforts to maintain adequate depths.

It took great efforts on the part of the people to secure sufficient funds with which to redouble the efforts to secure greater depths with improved dredging devices, and yet, with powerful dredging machines, the maintenance of a channel with as little as 20 feet depth was ineffective. Boards were created to report upon the subject, and much thought was expended upon the consideration of the various projects promising relief. The theories under which the bar formations occurred were fiercely debated, and the permanency of works at the mouths of the passes, and their adequacy, was thoroughly discussed. But at the root of all the propositions there was invariably found this recommendation: *That the full amount of money required to effect the improvement should be at once appropriated.*

As the estimated costs of any of the proposed improvements represented a vast sum at that particular time, when river and harbor improvements were in their infancy, it seemed that any relief was impossible, since Congress feared to take the responsibility for making such enormous appropriations for one locality. At this juncture there appeared a patriotic individual who seemed to appreciate the difficulties of the situation, and with a courage born of his convictions he proposed to Congress to do the work if he were to be allowed to follow out his ideas without restrictions, payments to be made to him as certain results were attained. There was fierce opposition to his proposition in certain directions, but the proposition possessed peculiar fascinations for Congress, if for no other reason that it solved the financial problem and promised *permanent results.* Above all things, it presented the element of economy and if applied at a smaller pass than that proposed, as South Pass, where it was believed satisfactory depths and widths of channel might be secured for a considerably smaller sum than it would cost to obtain parallel results elsewhere, all adverse criticism would be stifled.

Mr. Eads certainly deserves great praise for the able and successful manner in which he gained his point, although he did have to accept the smaller pass. His troubles had, however, only commenced, because he did not possess the private fortune necessary to carry on the work to the point where returns might be expected. He had promised much, and there were many who felt positive he could not accomplish all he promised. Outside assistance could not be obtained without paying great premiums, and many physical difficulties were experienced which were not anticipated. The much-vaunted claim that the channel, if properly constructed, would, *unaided by dredging or other stirring-up processes,* sufficiently strengthen the current to scour out the bottom with great rapidity was not fully realized, and dredging was found to be necessary; but the people were disgusted with the dredging operations to secure proper channels through the bars, and the necessity for dredging weakened confidence in the undertaking. It required extraordinary exertions on the part of Mr. Eads to restore confidence and prove, in face of the fiercely contested claims that the bar would advance with greater rapidity in consequence of the jetties than before, that no advance of the bar had taken place as intimated.

Mr. Eads's perseverance under such adverse circumstances is truly remarkable, and although he did go to Congress and secure material concessions relative to channel widths and depths, and methods of payment, he certainly succeeded in giving to commerce a far better channel than was deemed essential, although not equal to that promised, and which has lasted fairly well up to the present time.

The theories propounded for the explanation of the growth of the bar at the month of a pass, as Southwest Pass for example, are clearly stated in Humphreys and Abbot's Physics and Hydraulics of the Mississippi River. Briefly stated, the bar-building material consists of two varieties of earthy matter, that which is in suspension, and that which is pushed along the bottom. When this material reaches the sea end, it is deposited, owing to the loss of current in the stream which transports it. The volume of water issues in a fan shape from the channel formed by the banks. Its energy is dissipated upon coming in contact with the salt water, which opposes its exit, and the material which is carried along the bottom is soon brought to rest, while the lighter portion, held in suspension, is widely disseminated (owing to the fresh water gliding on the salt) and is deposited at much greater distances from the mouth. The material held in suspension forms, therefore, the foundation upon which the weightier particles are eventually placed.

The loss of energy, due to the resistance of the denser salt water and the lateral expansion of the stream, causes the shoaling of the water, and the depth of water maintained upon the bar is the result of an equilibrium between the eroding and depositing forces of the current. The form of the bar is greatly influenced by several forces, such as winds, waves, and countercurrents. If a current flows from left to right across the mouth of the pass, looking seaward, the material will be deposited in a greater quantity on the right-hand side of the pass, and vice versa. If the winds influence the countercurrents, then the direction of the prevailing winds will determine upon which hand the greatest deposits will occur. The waves have a tendency to flatten the bar and fill up all channels across it. The seaward slope of the bar is greatly influenced by the combined action of the currents and waves, being steeper on the side from which the currents come. If the effects of the countercurrents are not continuous, the result is that the channel across the bar is more or less deflected by the deposits on the side opposite that from which the currents arrive, and is more or less inclined toward the side from which the countercurrents proceed, or against the countercurrent. The advance of the bar will not be symmetrical with the axis of the pass. If, however, the countercurrents are feeble, the advance of the bar will be more or less symmetrical with respect to this axis.

If the spreading of the water can be prevented until the crest of the bar is reached, the current will be sufficiently strong, generally speaking, to project the material conveyed by it to some considerable distance beyond the point of issue; the deposit necessarily takes place in deep water, and a considerable time must elapse before the normal conditions are restored. The natural rate of progress of the bar does not give a proper conception of the time which will be required to bring about a restoration of normal conditions after the confining of the issuing water has been effected. In the first place, the point at which the normal crest of the bar must form will be in very deep water, and all the areas in advance and latterly must be filled up before this bar will be able to maintain itself. Secondly, this bar will build up faster, for the reason that the heavy matter is deposited over a shorter arc.

If a countercurrent sweeps across the axis of issue, much of the bar-building material will be deflected to one side and the advance of the bar will be retarded, but the direction of the entrance will be changed, since the channel through the new bar will incline toward the point of direction whence the countercurrent arrives, in which case the subsequent prolongation of confining works, or "jetties," as they are called, would be at an angle to the original line, and give rise to irregularities of channel between them.

When the advance of the bar is symmetrical the restoration of normal conditions is much more rapid, but the prolongation of the jetties is apt to be much simpler.

The improvement of Southwest Pass involves some considerations not heretofore fully touched upon. The character of the bar is somewhat different from the other passes. Numerous mud lumps arise at times some of these directly in the channel. These lumps introduce complex conditions at times, by stopping the regular flow of the water and so causing deviations of currents and abnormal deposits. The stability of any jetty construction is imperiled by these strange formations. To predict just what is going to happen in such a locality is impossible, and all estimates for improvement have to have a large margin for contingencies. The efforts of all former improvers were futile for the reason that insufficient funds were provided to make all work secure against all circumstances. To simply rely upon dredging at such an exposed place is futile, if any considerable increase of depth is desired. To rely upon construction works unaided by dredging is simply to invite disaster, since a single mud lump arising in the middle of the channel would block everything for a long time. It would undoubtedly have to be removed by dredging. A combination of dredging and contracting jetties promises the only solution of the problem of securing and maintaining deep water at this entrance to the Mississippi River for a profitable interval of time.

In this connection it may be well to review at length the various attempts made to improve Southwest Pass, and endeavor to ascertain the causes and conditions which determined success or failure.

The first appropriation for the improvement of the entrance to the Mississippi River was made in 1837, and upon the recommendations of a Board of Engineers an attempt was made to open the Southwest Pass by using the ordinary bucket drag. No permanent improvement was effected, as a single storm sufficed to obliterate all the work which had been done. Nothing further was done until 1852, when an appropriation of $75,000 was made for opening "a ship channel of sufficient capacity to accommodate the wants of commerce;" and it was further provided that the said money should be applied by "contract," and that the contract should be "limited to the amount appropriated." A mixed naval and engineer Board was convened by the Secretary of War to decide how the appropriation should be applied. This Board consisted of Commodore W. K. Latimer, United States Navy; Maj. W. N. Chase. United States Engineers; Maj. G. T. Beauregard, United States Engineers; and Capt. J. G. Barnard, United States Engineers; all of whom had served on the Gulf coast.

This Board reported that no other plan seemed capable of obtaining any important results than that of "stirring up" the bottom, and in accordance with this report a contract was entered into with the towboat association, by which a channel through the bar of Southwest Pass, 18 feet deep and 300 feet wide, was to be made. The harrowing and dragging process employed by the towboat association proved successful, and a depth of channel of 18 feet was maintained for a whole year.

It is important to remark that this Board recommended that in the case that the "stirring-up" process failed, jetties be constructed, remarking that the "project of jetties is based upon the simple fact that by confining the waters which now escape uselessly in lateral directions to a narrow channel, the depth of this narrow channel must be increased. In other words, the existing bar must be cut away."

As a consequence of no further appropriations being made until 1856, the 18-foot channel disappeared. The sum of $330,000 was appropriated in the year mentioned for the improvement of the passes. A Board of Engineers recommended that the bid of the towboat association be accepted for keeping open Southwest Pass by stirring up the bottom, and that the method of keeping open a pass by jetties and closure of lateral passes be applied to Pass a Loutre. The Secretary of War decided that the jetty system be applied to both passes, and a contract was accordingly made with Messrs. Craig & Rightor to do this work. The contractors began at the Southwest Pass by building on the east side a jetty about a mile long, "composed of a single row of pile planks, strengthened at intervals by piles." The structure was entirely too frail. and was so seriously damaged by storms that the plan was abandoned, and the contractors were permitted to resort to the stirring up process, by which an 18-foot channel was secured and maintained as long as the operation was continued.

In 1867 an appropriation of $75,000 was made and a contract entered into for "stirring up," which was not, however, executed. In the years 1867–1870 the Government built a powerful dredge boat of special design, which was operated under the very best of conditions, but since it simply functioned by stirring up the material with a powerful propeller, and deflecting the disturbed material up into the current with a deflector, it did not succeed in maintaining a much deeper channel than that formerly secured by other means.

The necessities of commerce made it imperative that a better channel connection with the Mississippi River be obtained at an early date. Everybody was tired of the uncertain results secured by dredging on the bars, and as other methods of securing these objects had been advocated, a resolution of the House of Representatives was passed March 14, 1871, providing: "That the Secretary of War be, and he is hereby, requested to cause an examination and survey, with plans and estimates of cost, to be made by an officer of engineers, for a ship canal to connect the Mississippi River with the Gulf of Mexico, or the navigable waters thereof, of suitable location and dimensions for military, naval, and commercial purposes, and that he report upon the feasibility of the same to the House of Representatives."

The survey and estimates for a canal, near Fort St. Philip, were submitted by Capt. C. W. Howell, Corps of Engineers, to a Board of Engineer Officers, composed of Col. J. G. Barnard, Lieut. Col. John Newton, Maj. Q. A. Gillmore, Maj. G. K. Warren, Maj. William P. Craighill, Maj. G. Weitzel, and Capt. C. W. Howell.

This Board, with the exception of one member, reported that the construction of the canal, with a depth of 27 feet and bottom width of 200 feet, having at the river end a lock with chamber 500 feet long, 60 feet width, and depth over sill 25 feet, was feasible and desirable, and was estimated to cost $10,273,000. The dissenting member, General Barnard, claimed, in a minority report, that the experience gained with the dredges was sufficient to warrant still better results, and that the advantages of an open mouth were sufficient to warrant further experiment in this method at Southwest Pass, but, he reasoned, that the success of the jetty system, as applied at the Saluna mouth of the Danube, presaged even greater success if applied at South Pass, and warranted its consideration.

Gen. A. A. Humphreys, Chief of Engineers, United States Army, criticised General Barnard's preference for jetties, and estimates that the rapid advance of the bar will make the extensions of the jetties costly and their maintenance uncertain; that the earthy matter brought to the crest of the bar was not deposited in deeper water, as was contended, but was laid upon the lighter material which was carried in suspension considerable distances beyond the bar and caused the greater portion of the fill, since it was by far the greater portion of the matter transported by the river; that the result of this was to really shoal the water in advance of the bar in such manner that the bar really advanced into shoaler water, and if the jetties were built the material would be restricted as to the areas on either hand, and the advance would be greatly accelerated in consequence.

General Newton, in a review of General Barnard's dissenting report relative to the application of jetties for the improvement of the entrance to the Mississippi River, practically reiterates General Humphrey's views and questions the permanency of the improvement, for the reason that the prolongation of the jetties to keep pace with the rapid increase in the bar would introduce so much resistance to the flow of water, in time, that the water would seek some other pass; furthermore, the prolongation of the main stream must be considered, since it is not known whether the delta advances simultaneously with the prolongation of the main stream, or whether the main stream did not prolong its course violently by breaking through at some point, and so discarding the passes which have for some time been advancing into the Gulf at the average rate of 262 feet per annum.

One of the most remarkable differences of opinion in these discussions is that which relates to the annual advance of the bar formation. General Barnard claimed that if the jetties were extended to the required depth of channel beyond the crest of the bar, and the channel deepened by dredging, the force of the current would be sufficient to project the material so far into the Gulf that the bar would not reach the height of the bottom of the proposed channel until the conditions as to fill and distribution of material in the Gulf approximated that which existed previous to the improvement. General Newton estimated that the bar advance at Southwest Pass would be as much as 1,014 feet per annum, and at South Pass 2,240 feet, the more rapid advance for the smaller pass being due to the greater contraction of the channel between the jetty heads.

The report of the Board upon the canal project was followed by the proposition of Mr. Eads, in February, 1874, to improve the entrance to the Mississippi River by jetties at Southwest Pass for the sum of $10,000,000, payments to begin when a depth of 20 feet was secured, and continuing as certain greater depths were secured until 28 feet had been secured and $5,000,000 had been paid. The remaining $5,000,000 to be paid in installments of $500,000 each, conditional upon the permanence of the channel for ten years.

A fierce controversy resulted as a consequence of this proposition between the advocates of the canal on one side and the supporters of the jetty scheme on the other, and since the principal part of the discussion was theoretical, it was impossible to decide which was the better until further investigations of the jetty methods could be had. Accordingly, in June, 1874, an act was passed constituting a Commission to investigate and report upon the improvement of the mouth of the Mississippi River. This Commission was organized pursuant to the following order:

GENERAL ORDERS, } WAR DEPARTMENT, ADJUTANT-GENERAL'S OFFICE,
No. 74. } *Washington, July 2, 1874.*

Lieut. Col. H. G. Wright, Lieut. Col. B. S. Alexander, and Maj. C. B. Comstock, Corps of Engineers, United States Army; Prof. Henry Mitchell, United States Coast Survey; T. E. Sickels, W. Milnor Roberts, and H. D. Whitcomb, are, by the President, hereby appointed a Board of Engineers under the provisions of section 3 of the act approved June 23, 1874, entitled "An act making appropriations for the repair, preservation, and completion of certain public works on rivers and harbors, and for other purposes," for the purpose of making "a survey of the mouth of the Mississippi River, with a view to determine the best method of obtaining and maintaining a depth of water sufficient for the purposes of commerce, either by a canal from said river to the waters of the Gulf or by deepening one or more of the natural outlets of said river." They are hereby directed to assemble at New York City, N. Y., on the 20th instant, or as soon thereafter as practicable, for the purpose of organizing and entering upon the performance of their duties. Lieutenant-Colonel Wright is designated as president of the Board. H. D. Whitcomb is designated to disburse, under the direction of the Board, the money appropriated to defray the cost of the survey.

The following is the section of the act of Congress above referred to:

"SEC. 3. That a Board of Engineers, to be composed of three from the Army, one from the Coast Survey, and three from civil life, be appointed by the President; which said board shall make a survey of the mouth of the Mississippi River, with a view to determine the best method of obtaining and maintaining a depth of water sufficient for the purposes of commerce, either by a canal from said river to the waters of the Gulf, or by deepening one or more of the natural outlets of said river; and said board shall make a full and detailed estimate and statement of the cost of each of said plans, and shall report the same, together with their opinion thereon, showing which of all said plans they deem preferable, giving their reasons therefor, to the Secretary of War, to be presented at the commencement of the second session of the Forty-third Congress; and that the sum of $25,000, or so much thereof as may be necessary, is hereby appropriated, out of any funds in the Treasury not otherwise appropriated, to defray the cost of said survey."

Approved, June 23, 1874.

By order of the Secretary of War:

THOMAS M. VINCENT,
Assistant Adjutant-General.

In the report of this Board, submitted January 13, 1875, it is stated: "As there has been no example in this country of the improvement of a large river mouth so as to give an outlet to the sea, with much deeper water than naturally exists on its bar, the Board, in its consideration of what experience has shown elsewhere to be practicable in such a case, has found its only examples in the mouths of European rivers.

"There has been great differences of opinion among engineers, not only in this country, but in Europe, as to whether the best method of securing a deep-water outlet from a sediment-bearing river which empties, like the Mississippi, the Vistula, the Danube, and the Rhone, into a nearly tideless sea, is by jetties or by a lateral canal."

In order to gain a better knowledge of the various rivers abroad which have been improved, the Board visited the rivers named, and also the North Sea and Suez Canal.

The result of these examinations abroad (while additional information has been gained on almost every point relating to the problem before them) has been to largely strengthen their estimate of the value for jetties at the mouth of the Mississippi River of the fascine dikes used in Holland by Calend in the improvement of the Maas mouth of the Rhine.

The Board visited the locality of the proposed canal below New Orleans, and fully considered its plans, etc. It estimated the cost to be $10,296,500 for construction, and $60,885 per year for cost of maintenance.

In considering the method of deepening the water on one of the bars by jetties, the Board makes the following statements:

"On examining a map of the mouths of this river it will be seen that each pass, through the greater part of its length, has a nearly constant width, but that it widens toward its bar, so that on its outer crest it has several times its ordinary width, while its depth is less in something like the same proportion. The cause of this change seems to be the following: The river water as it approaches the bar is somewhat above the level of the Gulf, and so tends to diverge, the stream thus becoming thinner and wider. This thinning and widening is aided by the greater density of the salt water, which makes the fresh water rise over it on a slope that is steeper as the velocity of the river water is less. This thinned sheet of water forms its own banks as the bar moves out to sea; but, as in this wide, shallow stream the friction is great near the banks, deposits begin there, the stream is narrowed and deepened, and in time that part of the stream obtains the form already assumed by the portion above, which allows the water to pass with least resistance. To-day, while there are but 7 feet of water on the outer crest of the South Pass bar, it is yet only about 12,000 feet from the bar to 30 feet of water above the bar, and it follows, if the bar's progress into the Gulf has been for the last one hundred and twenty years the same as for the last thirty-six years (about 100 feet per annum), that one hundred and twenty years ago the outer crest of the South Pass bar was where now there is a deep channel. As the bars move out to sea, the river is, then, all the time eroding a channel of the characteristic deep-water cross section behind and through them. The object of the jetties is to aid and hasten this erosion. If, starting from a point in a pass above its bar, where there are now 30 feet of water, we build jetties which so confine the pass that it shall have the width all the way to deep water it now has at the starting point, we shall be helping the pass to assume the deep-water cross-section it would ultimately take, and by aiding it, if necessary, by dredging, should be able to reduce at pleasure the time required for the process.

"This plan is then adopted for the improvement of a natural outlet, namely, to begin parallel dikes at the banks of a pass where there are now 30 feet of water in the middle and carry them over the bar to 30 feet water outside (unless the depth is obtained before the dikes have reached the 30-foot curve), allowing the river to erode the bottom between the dikes till the waterway between them everywhere has the same cross section as at their beginning, aiding the erosion by dredging or stirring if it is not rapid enough without.

"The Board considered the question of limiting the waterway to the cross section of 30 feet maximum depth by converging jetties on the bar, and by spur dikes in the Pass above, instead of by parallel dikes. In view of the lack of experience in such work in this country, and of the danger of excessive scour around the ends of spur dikes, it was deemed advisable to adopt parallel dikes as offering fewer contingencies and less difficulty of construction. The depth of 30 feet has been chosen in order that some time may elapse before the bar, which will form at the sea end of the jetties, can have less than 25 feet at mean low water upon it, that being the minimum depth which it is desired to maintain.

"Having adopted a general plan for the improvement of one of the natural outlets, it remains to fix on that one. As the improvement of any will be costly, but one should be improved, and that should be made adequate for all purposes.

"The passes which have been most carefully considered are the South and Southwest.

"In comparing these passes, it is seen that while the average width of the body of the South Pass is 700 feet, that of Southwest Pass is about 1,400. The greater width is more favorable to navigation; but, in the opinion of the board, the South Pass, when improved, will be adequate to the present and prospective wants of commerce. The estimated sum required for the construction and maintenance of the works for the improvement of the South Pass is $7,942,110, and for Southwest Pass is $16,053,124. It is assumed that the Southwest Pass bar advances about three times as fast as the South Pass bar.

"The South Pass being entirely adequate, the much greater cost of improving the larger pass would not, in the opinion of the Board, be warranted either by the somewhat greater ease of entering it in storms or of navigating it when once inside. The former is 12.9 miles long, the latter being 18 miles, and is lengthened only about one-third as fast as the latter.

"The cost of improving Pass a Loutre would also be far greater than for South Pass, without advantages sufficient to justify the increased cost. The South Pass has the advantage that the works for its improvement, which would require at least two or three years for their execution, would in no way interfere with commerce. The Board is, therefore, of opinion that if any natural outlet is improved it should be the South Pass.

"The South Pass of the Mississippi is 12.9 miles long, has an average width of 730 feet and a minimum interior channel depth of 29 feet. It is 11,900 feet from the 30-foot curve inside the pass across the bar to 30 feet outside. The minimum depth on the bar is 7 feet. It discharges at its mouth about 57,000 cubic feet of water per second and about 22,000,000 cubic yards of sediment in suspension per annum. It has a shoal at its head, with a minimum depth on it in channel of 17 feet.

"For the improvement of the South Pass the Board recommends parallel dikes or jetties constructed of brush, fascines, and stone, in the same general way as those used by Mr. Calend at the mouth of the Maas.

"These dikes should begin at the two banks of the pass, about 1,650 feet below the South Pass light-house, where the river has a width of nearly 900 feet and a maximum depth of 30 feet. They should run in straight lines parallel to each other in the direction of the pass to where the water is 30 feet deep outside of the bar, provided it should be necessary to carry them so far as to secure 30 feet depth. The dikes for the first 7,100 feet should be 10 feet wide on top; should then widen gradually to 20 feet in a further distance of 2,050 feet; should then gradually widen to 50 feet, which is to be the width in 30 feet of water. At present this last length would be about 2,750 feet and the total length of each dike 11.900 feet. The first 7,100 feet of the dikes to have side slopes of two-thirds (two vertical to three horizontal), the rest to have side slopes of one fourth down to 15 feet below water, and beneath that depth slopes of one-half; the top of the dikes to be rounded and paved, the crown rising to high water of spring tides.

"The question of the average annual expense of prolonging the jetties is a very serious one. It depends on the annual advance of the 25-foot curve, that depth being required. At present the muddy water issuing from the South Pass spreads out in somewhat of a fan shape, the handle of the fan being at the mouth of the pass and the ribs several miles in length.

"If the proposed jetties were instantly completed and the new channel scoured out essentially the same amount of sediment would be spread out in fan shape, but, from the greater velocity of the issuing water, the ribs of the fan would be longer while the handle would be narrower. More of the sediment would at first be deposited far out in the Gulf than before.

"But with the present rate of advance the 25-foot curve one hundred and twenty years ago was about 12,000 feet above its present position, and if the volume of water carried by the pass is kept the same, neglecting the slight difference in slope of the Gulf bottom outside the present bar, in about one hundred and twenty years a new end for the pass will probably be formed of the same general shape as the lower 12,000 feet of the present pass. It makes little difference, in the whole time required to accomplish the work, whether the same volume of water flows out at starting over the present shallow bar or from between two dikes which force the water to take a depth of 30 feet. In an average of many years the rate of progress must be about the same as now, namely, 100 feet per annum, the volume of water being kept as at present, and it is on this basis that the average annual cost of extension, namely, $130,000, has been computed.

"It has already been stated that it is proposed to obtain a depth of 30 feet between the jetties, in order that some years may elapse before the shoal which will form beyond the jetties can have on it less than the required depth of 25 feet in the channel through it. There are no precise data for estimating this period. Going seaward from the upper end of the proposed dikes, the slope of the bottom of the South Pass is about $\frac{1}{440}$. This slope doubtless depends mainly on the velocity of the water flowing through it and on the lifting of the fresh water by the salt. As the causes remain essentially the same, it would seem natural that the new end of the South Pass to be formed by the sediment passing through the jetties should at least have the same bottom slope. If this assumption were true, the bottom would at last shoal from 30 to 25 feet in a distance of 5 by 440 = 2,200 feet, and the time required would be about twenty-two years. This time would be shortened by two causes:

First, there are about 3,000,000 cubic yards of material to be scoured out between the jetties, thus increasing the general bar accretion by that amount and hastening the advance of the pass. As the scour would be distributed over several years, and as the South Pass carries about 22,000,000 cubic yards of sediment in suspension annually to the Gulf, the effect of this 3,000,000 yards can not be relatively large; second, at and below the point where it is proposed to begin the jetties the river velocity now diminishes very slowly, as it is confined by a slowly widening channel, while when the jetties are completed and the channel scoured out the water issuing from them will, having at first no banks to confine it, spread out more rapidly, thus, perhaps, losing velocity more rapidly and forming a steeper seaward slope on the bottom than now exists at the upper end of the proposed dikes.

"This steeper slope seaward from the 30 feet of water between the jetties would give a shoal of 25 feet at a distance of less than 2,200 feet, and in a period of less than twenty-two years. The period is uncertain; experience alone can determine the precise time. Different estimates made by this method, and others by different members of the board, vary largely, and ten years have been assumed for the purpose of estimate. In ten years, then, it is assumed that the jetties will have to be lengthened 1,000 feet. As shoals will have formed at the ends of the jetties, it has also been assumed that the extension will be in water averaging 15 feet in depth.

"It has been stated that there is a shoal at the head of South Pass, with but 17 feet of water on it. At present this shoal is scouring out. Should that scouring not give a depth as great as at the shoalest point below in the pass, the construction of a dike to deflect more water into it would become necessary. Should the South Pass increase much beyond its present size, it might become necessary to put an apron on the bottom and sides of the pass, near its head, to stop that increase."

The estimated cost of the jetties at South Pass were, for construction, $5,342,110, and $130,000 per annum for cost of extension, etc. For Southwest Pass a similar estimate was made, as follows: First cost of jetties, $8,253,124; annual cost of extension, $390,000.

The Board felt certain that the required depths could be secured by jetty constructions, and recommended that South Pass be improved in this manner, and concludes that if Congress adopts this system *that the whole amount should be appropriated at once or in some way be made available.*

Gen. H. G. Wright withheld his signature for the reason that he did not believe the method promised an adequate and permanent channel, which the canal project did, and therefore gave his preference to the latter method.

Soon after the presentation of this report Mr. Eads made a new proposition to Congress to make a channel 30 feet deep at the mouth of Southwest Pass for $8,000,000, and maintain it for twenty years for an annual sum of $150,000, a first payment of $500,000 to be made when a depth of 22 feet was reached, and other amounts as greater depths were reached until 30 feet was reached, when a certain sum was to be held as security for maintenance, one-half to be paid at the end of ten years, the other at the end of the twenty years. The complete statement is not repeated, for the reason that it was not accepted.

Gen. A. A. Humphreys, Chief of Engineers, opposed this measure, for the reasons, mainly, that the improvement would not be permanent, and that the rapid advance of the bar would render its maintenance inordinately expensive.

Mr. Eads's able presentation of his case before the House committee, backed by the favorable report of the Board, sufficed to withdraw all opposition, practically, in the House; but when the matter went to the Senate, the possibility of gaining the same results at South Pass at far less cost influenced the members to advise Mr. Eads that if he would not agree to improve the smaller pass for $5,250,000, with the same guarantees, and agree to maintain the 30-foot depth for twenty years at $100,000 per annum, the work would not be placed in his hands. He consented to this, and the bill covering the conditions of the work, modified as to cost and location, became a law March 3, 1875.

The jetties at South Pass were declared finished in July, 1879, at which time the payment for maintenance began to run, and the maintenance of the required channel has been complied with, with the exception of about five hundred days, to date, when the legal channel did not exist. The deficiencies have been distributed between the pass itself, the jetty channel, and the channel through the bar in the Gulf in advance of the ends of the jetties.

The channel in the pass proper is required to have a navigable depth of 26 feet throughout, from the deep water of the main river to the beginning of the jetty channel.

The jetty channel is required to have a channel 26 feet deep and 200 feet wide, with a central depth of 30 feet without regard to width, this channel to continue to the deep water of the Gulf.

Between the river and the jetty channel the pass has filled considerably in places, the tendency apparently being to assume an uniform cross section and slope.

Between the jetties filling has occurred at intervals; but the channel is maintained with reasonable success by dredging. Beyond the jetties a bar has formed, through which a channel is maintained with but little dredging so far. A chart showing the advance of the different curves of depth between 1879 and 1896 beyond the sea ends of the South Pass jetties is attached.

CONCLUSIONS.

Upon examining this chart, the manner of the re-forming of the bar is disclosed. The greater portion of the sediment ejected by the pass is deposited to the westward. The 20 and 30 foot curves exhibit this in a marked degree in the immediate vicinity of the jetty ends. The 40-foot curve seems to be less affected in the area examined, but probably inclines shorewards on the easterly side upon the prolongation of the line shown. The 50-foot curve of 1896 probably inclines shorewards on the east, like the 40-foot, but all the curves beyond the 40-foot curve of 1896 are very irregular, though possessing identical features. Three distinct valleys are indicated as penetrating the formation in front of the jetty ends; a very pronounced one to the east, a second similar one to the west, and one not quite so pronounced between these. Below the 40-foot curve of 1896 a ridge extends as far as the 100-foot curve, and probably beyond. This ridge is in line with the 30-foot channel between the jetties, and that through the bar to the eastward of the axis. The ridge to the west of this is not so marked, and the middle valley may almost be disregarded as of little consequence compared with the very pronounced valleys to the east and west of it. These deep valleys have their center lines inclined nearly in the direction of the prevailing wind, and are due to wind and tidal currents, which oppose the issuing stream and deflect it to one side or the other. Between these valleys the important advance of the bar has taken place, since this included area is in front of the jetty entrance.

The shoal which has formed directly in front of the entrance is the outgrowth of several conditions: First, the sediment which was deflected by the cross current; second, the finer material which floated beyond the influence of the river current, and was returned by the action of the wind and waves. This shoal is having more and more influence upon the issuing current, and tends to deflect it more and more into the face of the prevailing winds. The ultimate effect will be to cause the direct interference of the cross current and issuing currents, and a consequently more rapid deposition of the material to the eastward of the line of issue. The speedy restoration of normal conditions will then result, for the influence of the jetties will no longer prevail, the extension of the bar will resemble that before the improvement was undertaken. The material to the eastward of the jetties will be far less than that to the westward, however, and when the extension of the jetties to meet the new conditions becomes necessary, the east jetty will not have the width of foundation to insure its permanence for any considerable length of time.

The issue of the water from the opening between the jetty ends shows that the force of the current is sufficient under present conditions to not only carry the sediment some distance in advance of the jetties, but to excavate a basin of considerably greater depth than that in the channel between the jetties. The force of flow is therefore sufficient to drive the salt water from in front of the entrance and hold it in abeyance for the greater part of the time that the issuing current is charged with a material amount of sediment, and during low river, when there is no sediment in suspension, the ebb tide is sufficiently strong to maintain this small basin and the channel through the bar, the shoaling effect of the tidal current being greater between the jetties than outside.

Unless the sediment borne to the mouth of the jetties could be entirely eliminated, it is folly to imagine that such a system of improvement can give permanent results, and although the prolongation of the jetties may not be required, and, indeed, be impossible for some time, there surely comes a time when prolongation must take place, and this extension will be both expensive and difficult.

The prolongation will have to be made on the narrow ridge directly in front of the jetties, where the shoaling is greatest and the duration of the beneficial results the least, or a lateral course must be pursued with far less promises of durability. The system itself is incapable of being made *to endure for all time*, but must, in the natural order of things, come to a positive end and be abandoned.

The principles of bar formation are practically as stated by Humphreys and Abbot, so long as the natural conditions exist. The bar advance is explained and the theory is sufficiently exact to meet the situation, but when the natural conditions are disturbed by the construction of confining jetties the advance of the bar is not made in exactly the same manner, since the issuing water has sufficient force to carry the material some distance into the sea, where the deposit takes place in deep water and where the re-formation of the natural bars commence and grow, until the conditions in advance have been restored and the lateral areas built up so as to form natural banks or shoals, and so bring about a restoration of natural conditions.

The natural rate of advance of the bar gives an approximation of the time which may be estimated to elapse from the time when the jetties are completed to the time when the bar will have re-formed, or to the time when the further extension of the jetties will be necessary, supposing the conditions at the Head of the Passes to continue favorable.

At South Pass the depth of channel required is 30 feet at flood tide. The 30-foot curve has advanced between 1879 and 1896 a distance of about 700 feet. Measured on a line from the most advanced point of the curve of 1879, and parallel with the present 30-foot channel through the bar to the westward of this, the advance has been much greater. On the prolongation of this line, where the advance of the 40-foot curve has been the least, the advance of the 40-foot curve has been 900 feet, and practically occupies the position of the earlier 50-foot curve. Beyond the 40-foot curve the advance of the other curves have been far greater, the 60-foot curve of 1896 coinciding with the 80-foot curve of 1879.

The distance between the 30-foot curve outside the natural mouth and 40-foot curve before the jetties were built was 1,600 feet, or a slope between of $\frac{1}{160}$, and between the 40-foot and 50-foot curves the slope was $\frac{1}{20}$. At present the slope between the 30 and 40 foot curves is $\frac{1}{90}$, or much steeper, and between the 40-foot and 50-foot, measured on the same line to the nearest point of 50-foot curve, about the same slope ($\frac{1}{90}$), much flatter.

Before improvement, the distance from the inside 30-foot curve of depth to the 20-foot curve of depth was about 2,900 feet. The end of the 30-foot channel was well inside of the protection of the natural banks; but measuring off the 2,900 feet from the ends of the jetties, in the direction heretofore used, the end of this measurement would fall about midway between the most advanced and least advanced positions of the present 40-foot curve of depth in the Gulf, as the filling at this locality has been about 0.6 of a foot a year. If this rate was to continue, the 40-foot depth would have shoaled to 20 feet about the year 1929.

Originally the distance between the 30-foot curve inside and the same curve outside was 12,300 feet. In 1896, from the ends of the jetties to the outside of the 30-foot curve, ignoring the channel through the bar, which has failed, at times, to maintain the 30-foot depth, the distance is only about 1,600 feet.

The plateau which supports the bar, which has less than 30 feet of water over it, is very large, and is approximately without limits on the eastern side. So long as this condition prevails the growth of the bar in height will be retarded, but this condition will be greatly changed when the bank on the west has extended a little farther. It is reasonable to expect that when the 20-foot contour shall have reached the present 50-foot contour's position the bar will have considerably less than 30 feet of water over it, or through it. At the present advance of this 20-foot contour the 50-foot contour will be reached, in all probability, by 1913; at the present time the 30 and 40 foot curves approach each other closely on the west side. On the east side the approach is not so near. The 30-foot about coincides with the 40-foot contour of 1879, while on the west side the 20-foot contour coincides with the 40-foot of 1879 (later survey shows it has nearly reached the 40-foot), or the 20-foot (of 1896) contour advances much more rapidly than the 30-foot on the east. Unless the basin in front of the jetties enlarges much more rapidly than it does, the bar will be so broad that it will be impossible to maintain through it with a reasonable amount of dredging a channel of 30 feet, and it is doubtful if this channel could be maintained uninterruptedly at 25 feet for any length of time.

Under the very best of conditions, the life of the 30-foot channel, created and maintained by jetties and dredging, will not last at South Pass beyond 1913, or say for thirty-four years from completion, although the restoration of the bar to its natural condition would require one hundred years or a greater period.

The situation at Southwest Pass is not so favorable as at South Pass, so far as the transverse current is concerned, the current being comparatively weaker at this place, the advance of the bar appearing to be very symmetrical with the axis of the pass.

The advance of the bar between the time of the survey of this pass by the Coast Survey of 1867 and the present survey is shown on the accompanying chart. This covers a period of thirty-one years, and the annual advance for this whole time is at the rate of 251 feet a year. To maintain this advance, it would require, to fill up the areas in advance and on either hand, the annual deposit of about 32,000,000 cubic yards of material, sufficient, if it were piled on the square upon which the Capitol at Washington stands (a square which is about 1,650 feet by 1,400 feet), to raise the level of the ground several feet above the top of the statue on the top of the Capitol dome.

The rate of advance of the bar has undergone considerable variations at different epochs, as shown in Mr. Ockerson's report. In the interval between 1838 and 1857 the advance was 239 feet per annum. In that between 1857 and 1873 it was 401 feet per annum, and between 1873 and 1898 it shows but 176 feet advance per annum. The interval previously alluded to covers part of the time when the bar had its most rapid advance and is, therefore, considerably greater than the present.

There is a very material falling off in the advance of the bar since the survey of 1873. If the quantity of material transported is proportioned to the volume of water, it would appear that the volume of discharge had materially diminished. In 1873, at flood tide, the discharge was stated to be 408,000 cubic feet per second. Mr. Ockerson's observations give 370,000 cubic feet as the discharge, when the river was at something less than a high-water stage, probably what might be called a mean high-water stage, and for such a stage the discharge is stated to have been, in 1873, 340,000 cubic feet.

The exact data relative to the stage of the river corresponding to the mean high water is not stated. It may be inferred that the discharge of Southwest Pass has not diminished materially since 1873, or sufficiently to account for the decrease in the rate of advance in the bar since then. It is possible that the character of the material brought to the bar has undergone some changes in recent years, and the heavier material which forms the bar proper may have diminished, and the lighter material held in suspension increased. (The rapid advance of the 60 and 70 foot contours of depth at South Pass would indicate some such change.) There may also have been some deflection of the heavier material at the head, owing to the sill sunk across the pass by Mr. Eads. The advance of the bar into the Gulf, since greater depths must be filled in, will account for some of the loss, but there certainly remains a considerable loss of bar-building material that is unaccounted for.

During the times the bar was advancing rapidly, the depth of water on the crest of the bar was the greatest. This would appear to indicate a loss of velocity which, since the discharge at the head of the pass seems to be unchanged, could only occur through the increased discharge of the lateral openings above the mouth.

The slope of the pass varies from 2 feet at high water to 0.6 foot at low water. At high water the slope is very steep from the head to about one-fourth the way down, where some irregularities occur. From below this point to the Pilot Station Bayou the slope is more moderate, but is adequate to give sufficient velocity of flow to the water to enable it to maintain a very deep channel. Between the last station inside the banks to Stake Island the slope is much steeper than the section just above. As this last section is where the expansion of channel occurs, this sharp descent is to be expected. If the slope can be equalized throughout the entire length of the pass, from head to crest of bar, it seems that it would be sufficient to maintain a satisfactory current to deepen the channel across the bar to as much as is desired. To accomplish this the pass will have to be leveed and all lateral openings closed.

The principal object to be gained in constructing the levees and jetties is to secure, if possible, a channel from end to end of the pass, which shall have, as nearly as possible, an uniform capacity for discharge, and be as free as possible from bends throughout.

As the prolongation of the jetties will in time be necessary, the durability of the constructions must be such that no reconstruction will be necessary, but the work must be capable of extension, without unnecessary expense for preparation.

Although the pass is longer and the discharge of sediment greater than at South Pass (it is not deemed profitable to look further for an example), it is believed that the deeper channel can be maintained with a reasonable amount of dredging for at least thirty years, and that the extension of the jetties will not be positively demanded until some time later.

JAMES B. QUINN,
Major, Corps of Engineers.

D.

LETTER OF MR. M. J. SANDERS, CHAIRMAN EXECUTIVE COMMITTEE OF THE GENERAL CONFERENCE ON IMPROVEMENT OF CHANNEL AT MOUTH OF THE MISSISSIPPI RIVER.

EXECUTIVE COMMITTEE, GENERAL CONFERENCE
ON IMPROVEMENT OF CHANNEL AT MOUTH OF THE MISSISSIPPI RIVER,
New Orleans, December 7, 1898.

DEAR SIR: Referring to the question of the economic value of the improved channel from the Mississippi to the Gulf of Mexico, which the committee I represent, together with the commercial communities of the West, are urging upon Congress, and which your Board has been appointed to report upon, I desire as briefly as possible to call your attention to a few facts, by no means complete, in no way giving a full statement of the case, but sufficient, I trust, to demonstrate to yourself and the members of your Board the economic value of a 35-foot channel from deep water in the Mississippi to deep water in the Gulf of Mexico.

The matter is not in the slightest degree a local one, being fully as national as any subject of the kind can well be; but an interesting local statement, such as I beg to hand you herewith, is probably of value in considering this matter.

This statement shows the exports of two articles produced in this country, and makes a comparison between the movements through the port of New Orleans at three periods of about ten years' space of time between each.

I start it with the year 1879, because that was really the first year after the opening of the present channel by Eads through the South Pass, with full 25 to 26 feet of water from the river to the sea in place of the previous depth of 17 to 18 feet over the Southwest Pass bar.

You will observe that the exports of two main products of the year ending August 31 last, cotton was 2,752,000 bales, or about 700,000 tons, grain 41,819,000 bushels, the latter product showing an enormous increase, the quantity being three times as great as the year 1887. It is evident from this statement that the port of New Orleans is of great importance as a means of transportation for the products of the cotton and grain farmer. Besides these products there was exported staves and lumber, cotton-seed products, such as oil, oil cake and meal, and considerable flour and packing-house products of various kinds, etc., to the extent of 800,000 tons.

To arrive at the comparative value of our present channel through the South Pass, as compared with the one we are requesting Congress to give us, with 35 feet water through Southwest Pass, it is advisable to figure the relative economy in ocean transportation which is possible and probable when the products of this country can be exported in such tonnage as that for which we require the deeper channel.

Take as an example a comparison on a cargo of wheat and consider the results of a voyage made from London to New Orleans in ballast, returning with such cargo on two classes of ocean grain-laden vessels, the largest the present pass can accommodate, and one for which a 35-foot channel is required. The first would represent a vessel of 3,000 tons net register of modern build, having a capacity of some 6,000 tons of grain and drawing 25 feet.

Presuming this vessel obtains a rate of freight of 12 cents per bushel from New Orleans to London carrying 240,000 bushels, she makes a freight list of $28,800.

With a 35-foot channel from deep water of the Mississippi to the Gulf a vessel of 6,000 tons net register could safely reach the Gulf carrying a cargo of 12,000 tons' weight, or 480,000 bushels of wheat, which is just double that of the largest grain cargo that can leave the port of New Orleans to-day on the average style of vessel.

After careful figuring and speaking from actual knowledge derived in some twenty-five years' experience in shipping, I can venture to state, with confidence, that, owing to the enormous relative economy of the larger vessel, the shipowner would reap as good results on the voyage of the 6,000-ton vessel as is at present obtained on the 3,000-ton vessel at a freight rate hence to London of 8 cents per bushel; that is 4 cents per bushel, or 33⅓ per cent, less than is required by the smaller vessel to make the voyage profitable, an economy on the one cargo of $19,200.

Allowing the reasonable supposition that the trade of New Orleans will continue to increase in the next three years as it has in the past, we may look for exports from this port of at least 60,000,000 bushels of grain in the year 1901, and provided the business of this port can then be carried in vessels for which a 35-foot channel is requisite, and at a saving of 4 cents per bushel less than the present basis, there is a saving to the producer on the one product of grain alone of $2,400,000 per annum.

Upon cotton, figuring an export of 3,000,000 bales and taking one-half cent per pound as our basis of present rates, we can rely upon a saving on the larger vessel of at least 85 cents per bale, or a total of $2,450,000.

Without allowing an increase on other products, but granting the same relative economy on them as on grain, and on the same basis it amounts to about $1.80 per ton, or about $1,440,000 annually.

Summarizing, we have on this basis an annual economy on the products from the port of New Orleans alone—

Grain	$2,400,000
Cotton	2,450,000
Other products	1,440,000
Total	6,290,000

This represents the annual economic value of a 35-foot channel in excess of the present one from the Mississippi River to the sea on the actual exports of the products of this country, which at present find their way via the port of New Orleans to the markets of Europe.

As each port in the United States is in direct and constant competition with the others (all transportation rates being figured from the point of production in the interior to the market of the consumer in Europe), deep, navigable channels and economic ocean transportation at any one port have immediate effect on the cost of transportation by all other routes, and therefore upon the whole exports of the country.

The total export of wheat and corn to Europe during the year 1897 was 221,000,000 bushels; of cotton, 6,000,000 bales, besides an enormous quantity of other products.

The economic value of deep, navigable channels is beyond question, and of that from the Mississippi River to the ocean I think the above serves to fully demonstrate.

Upon other grounds, the development of the great inland waterway of the river Mississippi and its tributaries, upon which Congress has spent and is spending millions with great advantage to the country at large, most of which is noneffective without a modern channel to the ocean at the river's mouth, and of the necessity for an unequaled fresh-water harbor for our naval vessels, I will not now elaborate; but trust I have said sufficient to justify your Board in not only reporting favorably upon the engineering practicability of our request, but in urging upon the Government its advisability in the interests of the nation's welfare.

Yours, very truly,

M. J. SANDERS,
Chairman Executive Committee.

Col. H. M. ROBERT,
President Board of Engineers Southwest Pass, New York.

Statement of exports from the port of New Orleans to Europe.

Year.	Number of vessels.	Tonnage (net register).	Cotton.	Grain.	Other general freight.
					Cottonseed products—oil, meal, cake, lumber and staves, etc.
			Bales.	*Bushels.*	*Tons.*
1879	996	984,000	1,898,000	7,581,000	(a)
1887	1,078	1,200,896	1,655,347	14,112,000	(a)
1897 to Aug. 31, 1898	1,353	2,139,343	2,752,000	41,819,000	800,000

a No record.

E.

MEMORANDUM RELATIVE TO STEAMSHIPS TRADING WITH THE PORT OF NEW ORLEANS, LA.

[Furnished by Mr. M. J. Sanders, chairman executive committee, general conference.]

There are 13 foreign lines, operating 108 steamships, making regular voyages from New Orleans to foreign ports. There are about 200 other steamships making irregular trips, most of them "tramps."

The 19 largest steamships now plying to this port are as follows, viz:

Name.	Length.	Width.	Depth, hold.	Capacity, dead weight.	Draft, loaded.	
					Head.	Stern.
	Feet.	*Feet.*	*Feet.*	*Tons.*	*Feet.*	*Feet.*
Musician	400	47	31.6	6,880	25.4	26.4
Columbian	420	49	33.6	7,900	25.3	27.3
Antillian	420	49	33.6	7,900	25.3	26.8
Tampican	445	45	30	7,000	25.9	27.9
Mohtmorency	445	51.8	38	8,220	24.6	26.6
Melrose	445	51.8	38	8,220	24.6	26.6
Montrose	445	51.8	38	8,220	24.6	26.6
Monterey	445	51.8	38	8,220	24.6	26.6
Montcalm	445	51.8	38	8,220	24.6	26.6
Craftsman	450	52.6	30.9	9,050	25.8	27.8
Workman	450	52.6	30.9	9,050	25.8	27.8
Historian	460	55	36.6	9,700	25.8	27.8
Monarch	485	56	34.10	11,550	27	29
Milwaukee	485	56	34.10	11,550	27	29
Mount Royal	485	56	34.10	11,550	27	29
Politician	485	56.3	34.10	10,400	26.1	28.1
Collegian	485	56.3	34.10	10,400	26.1	28.1
American	485	55	39.6	11,150	27	29.6
European	485	55	39.6	11,150	27	29.6

Two steamers now nearly ready to start on their first voyage to this port are 500 feet long, will carry 13,000 tons, and draw, with full load, 29 feet forward, 31 feet aft.

The *Monarch* cleared on the 11th of this month with 20,946 bales cotton, 128,571 bushels corn, in bulk, 18,941 staves, a total of 9,224 tons.

F.

MINUTES OF PUBLIC HEARING HELD BY THE BOARD IN NEW ORLEANS, LA.

New Orleans, La., *November 30, 1898.*

Minutes of meeting of the Board of Engineer Officers appointed to determine upon the practicability of the improvement of the Southwest Pass of the Mississippi River, so as to secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico; containing addresses delivered in behalf of the improvement of Southwest Pass by members of the citizens' committee for the improvement of the mouth of the Mississippi River.

The meeting was called to order at 10.45 a. m. in the office of the United States engineer, custom-house, New Orleans, La., November 30, 1898.

Present: Col. Henry M. Robert, president of the Board; Maj. James B. Quinn and Maj. Dan C. Kingman, Corps of Engineers, and a number of gentlemen representing the shipping and commercial interests of New Orleans.

The president stated the objects of the meeting; that the Board was appointed by an act of Congress to determine upon the practicability of the improvement of the Southwest Pass of the Mississippi River, so as to secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico.

The president then called upon Mr. M. J. Sanders, as chairman of the citizens' committee, to make such remarks as he desired in regard to the matter.

Mr. Sanders stated that he wished first to introduce to the Board and the gentlemen present Mr. Walter C. Flower, mayor of the city of New Orleans.

Mr. Flower arose and delivered the following address:

"I have come more in the capacity of a looker on and a listener than to suggest any views to this Board in meeting here, but I have come, with the heads of the departments of the government, to say that this matter is of such vast importance to the city of New Orleans that there is nothing that can be done that the city and her people are not ready to do to have this work done. Some six or eight months ago the maritime association having charge of the matter, headed by Mr. Sanders, went with some of the commercial bodies from New Orleans as a delegation to Congress for the purpose of impressing upon the waterways committee the absolute necessity of some improvement in this direction. I had the honor, at the very last moment, of being added to that committee that went to Washington on that occasion, and I found, when we had listened to the very exhaustive disquisition upon the subject, both of the commercial importance and feasibility of this channel, as handled by Mr. Sanders and Governor Francis, of Missouri, that I felt then, and I feel now, that all the facts were so clearly condensed and put before that committee that little could be added by anyone who had not made a special study of the subject.

"I think Mr. Sanders is thoroughly posted upon the needs of the commerce here which requires this additional outlet, and I hope we will have the pleasure of hearing from him fully upon the subject, but I want to impress upon the Board more particularly the importance of this matter to the city itself.

"In 1872, when the question was first agitated of furnishing an outlet to the sea, a scheme was proposed by the celebrated engineer, Eads, but it was with great difficulty that he impressed his ideas upon Congress and secured the right and privilege of making the experiment. Surveys were made, but the engineering feat was considered so doubtful that he was given the very worst outlet at the mouth of the Mississippi River upon which to make his experiment—a small, narrow gut, near two other outlets, which were the natural outlets. We all know that he took South Pass, with 8 feet of water over the bar, and also that he has succeeded by these jetties in giving an outlet to commerce here, and that we have 25 or 26 feet to-day, and that it has been maintained, with the exception of an occasional blocking of the channel.

"We believe that if that work had been done on Southwest Pass that a channel ten times as wide could have been obtained, and that he could have succeeded in getting 35 feet depth there as well as he obtained 25 feet through the narrow pass he had to use. The purpose of this committee in going before Congress was to impress that view upon the waterways committee. They listened attentively and seemed to be impressed with the arguments presented. We then called upon the Speaker of the House and were pleasantly received, and received an intimation from him that he would favor the scheme.

"Now, we did succeed to the extent of getting an appropriation of $10,000 for a preliminary survey of Southwest Pass. The matter is now about to culminate; it is in the hands of you gentlemen. The Government pays the greatest deference to the views of the members of the Engineer Department, and I feel sure that if, after the inspection you have made, you consider this purpose feasible and the expenditure required not excessive in proportion to the amount of good it will do, I believe that you will recommend it to Congress, and that that recommendation will result in giving to New Orleans and the entire Mississippi Valley this very much needed outlet and highway to the sea."

Mr. M. J. Sanders then addressed the Board as follows:

"Mr. Chairman and Gentlemen of the Board: I feel considerable diffidence in addressing you to-day, because I am, perhaps, more oppressed with a feeling of the responsibility that we have in this matter than most of the community of New Orleans. And again, that our committee, though it was originally a representative body from the exchanges of New Orleans, one appointed by the Board of Trade and added to by the various other exchanges of the city, now represents, not the exchanges of New Orleans only, not the commercial community of the South only, but we actually represent to-day, in all that we say and do in regard to this highly important matter, the expressed opinion of 14 States of the Union; the expressed and emphatic opinion of conventions that have met in different parts of the United States and have passed resolutions affecting this project.

"I have deemed it in order that I read you, very briefly, extracts of opinion from people away from this city, because I want you gentlemen to understand that this enormous undertaking which you have in hand, under the act passed by the last Congress, is in no sense a purely local one. I wish to clear that idea from the mind of everyone, and to convey that this matter is absolutely national, and I want to show you in these few brief paragraphs that they go to prove that view.

"At a meeting of the Trans-Mississippi Commercial Congress, held at Salt Lake City, Utah, July 14–17, 1897, the following resolution was adopted: '*Resolved*, That the phenomenal increase in size, draft, and carrying capacity of ocean steamers, and the present proportions of traffic and its wonderful increase, makes imperatively necessary a larger, better channel through the mouth of the Mississippi River to the Gulf of 32 feet at mean low tide and 500 feet wide its entire length. This congress urges that the Government shall make every proper speedy effort to that end.'

"Adopted at the Convention on the Improvement of the Western Waterways, in Davenport, Iowa, October 6 and 7, 1897: 'The growing commercial necessities of the city of New Orleans, which is already the second port of the United States in point of exports, and the entire Mississippi Valley, of which it is the natural outlet, demand that it should be provided with a certain, permanent, and better exit to the Gulf of Mexico. The increase which of late years has taken place in the size and carrying capacity of ocean-going vessels has made the outlet through the Eads jetties wholly insufficient to meet the demands of commerce. Inasmuch as the Eads contract will shortly expire, we urge upon Congress the pressing importance of immediately deepening and widening the channel through the South Pass, so as to accommodate the largest ocean-goers. In our judgment the great and growing importance of that port makes necessary a navigable channel of at least 32 feet, and in order that there may be no interruption of ocean traffic we urge that a scientific and careful survey be made of the Southwest Pass, which is the best natural outlet, with a view of improving the same so that it may also be adapted to all possible demands of ocean commerce.'

"Adopted by the Ohio Valley Improvement Association, in convention at Evansville, Ind., October 13 and 14, 1897: 'The commercial and transportation interests of the port of New Orleans having declared the present channel at the mouth of the Mississippi River insufficient for the needs of commerce and of the great ships coming to the port, and in order that the interchange of products with the Ohio Valley and the markets of the world may be protected from any consequent hamperings and interruptions, we therefore urge upon Congress the propriety and necessity of providing for the extension and deepening of the present jetty channel as may be recommended by the United States engineer in charge.'

"Still further, the National Board of Trade, at its annual meeting in the city of Washington on December 15, 1897, adopted the following resolution:

"'*Resolved*, That Congress be requested to take such action at its present session as will initiate the work of improving, by the jetty system or otherwise, the Southwest Pass to the Gulf, so as to provide for the continually growing needs of the foreign commerce of the Mississippi Valley, besides protecting and permitting the incoming and outgoing of vessels in the event of obstruction of the South Pass.'

"The Cincinnati Chamber of Commerce and Merchants' Exchange, on January 7, 1898, addressed the Committee of Congress on Rivers and Harbors as follows:

"'* * * In our judgment there is no question to be considered by the Congress of the United States at this time of more importance with reference to the industrial welfare of our people than that of provision for the needful improvements of the channel at the mouth of the Mississippi River, the influence of which upon the commerce of our country being far-reaching and of very great significance. It is manifest that prompt and proper governmental action must be had to avert the threatened interference with ocean traffic, by which transportation would be affected to the great prejudice of the productive interests of the vast region concerned.'

"I have read these to show you that there is no localism in the question. The gentleman previously explained that the need is not local; that we are but the representatives, and not the most concerned, of the whole of the great West, from Minnesota to the Gulf, from the northern extremities of the country right down to our present locality.

"Now, gentlemen, I will try to show that the present channel is insufficient. We know that it is insufficient, and we have shown to Congress, we think, clearly, that it is insufficient from the question of depth—that there is not the depth of water necessary for the present needs of commerce. I have recently had brought to my experience a fact which shows that it is insufficient for another reason altogether, and that is that vessels built to-day of a length of over 500 feet can not navigate the channel, even if these vessels drew but 20 feet of water, which is almost an impossibility in naval construction nowadays, unless the ships are in ballast. Only recently a vessel of that size desired to come to New Orleans for traffic. Her owners investigated the conditions of the pass as thoroughly as they could. By the aid of pilots and master mariners who used that pass largely, they finally came to the conclusion that there was no safety in a vessel of 550 feet long navigating the pass from the Mississippi River to the Gulf that we now have.

"Gentlemen, we require from you a pass with a minimum depth of 35 feet of water. It has been said that a depth of 32 feet would do, but, though that statement is but twelve months old, we find to-day that if we are to be in the front ranks of competition with other ports of the country, 32 feet is too shallow a depth to work upon. We must have 35 feet. To-day there are vessels building, intended for this port, that will draw 32 feet of water aft when they are properly loaded, and there are vessels building to-day, intended for United States ports, that will draw more than that. We have to-day running to this port 18 vessels drawing from 28 to 32 feet of water, allowing only 1 foot of water under the keel of the vessels, and that is entirely inadequate for vessels carrying 12,000 tons cargo. We have two vessels to be completed within the next few months, and they will require an absolute draft, when loaded properly, of 31 feet of water to go from this port to sea. Their length will be over 500 feet, and they will possess a carrying capacity of 12,000 tons.

"These are not the requirements of the future, but our present requirements if we are to secure the commerce of the port in competition with other ports, economically, as required.

"As an evidence of the commercial value of a 35-foot channel, I will say that a vessel of 500 feet length and 31 feet draft loaded will carry, roughly, 480,000 bushels of grain. A number of vessels coming to this port and drawing 26 feet of water (more than the present draft in the channel) will carry only 240,000 bushels, just half the capacity of vessels going through the pass, as compared to the capacity of the vessels going through a pass of 35 feet of water. So you see 35 feet of water at least doubles the capacity of vessels that can trade with the port. The economy of such vessels, it is, perhaps, scarcely necessary for me to allude to at present, but I will say that a vessel carrying 480,000 bushels of grain can carry at half the expense of one carrying only 240,000 bushels, so the economy to the purchaser, in transportation alone, is anywhere from 75 per cent to 100 per cent under the difference in the depth of water which we now have through the present pass and the water which we ask you gentlemen to provide for us through Southwest Pass.

"Another matter of importance, and another very strong reason why there should be a channel of this size into the Mississippi River from the Gulf, is the probable present and future requirements of this country as a naval station. We know of no port in the Gulf of Mexico, or in Southern waters, that can so effectively, so economically, provide such a harbor as is needed as can the river Mississippi, when you give us this channel through Southwest Pass. To-day we hear that Japan proposes to build a ship of 15,000 tons displacement. Such a vessel could not begin to enter through the pass of this river. It seems that the United States and other countries will have to follow with large warships, but it is certain that a number of the vessels of the United States Navy can not get into this port with the present depth of water. Therefore, from the point of view of naval requirements, there is need for a deeper and better channel than South Pass.

"And if you give us this depth there is as fine a harbor as any country can show.

There are hundreds of miles of safe anchorages in safe water—room for the vessels of the world.

"The Government is contemplating expending some $800,000 for a dry dock here, which is to accommodate vessels up to 800 feet long. That dry dock will be perfectly useless unless you provide a channel that bigger ships can come through to use that dry dock.

"There seems to be no doubt whatever of the necessity for this channel that we require and request of you through the Southwest Pass. I do not propose to take up much more of your time, and I come now to the last point which I have to make, and by far the most important point of all, and that is the urgency of this question. I may seem, in the remarks I am going to make, to be exaggerating for effect, but I do not propose to utter one word of exaggeration or deviate one atom from what I believe to be the facts of the case.

"The trade of this port, the commerce of the Southwest, is in imminent peril. We are dwelling in a fool's paradise; we are living on the edge of a volcano, and are liable, at any time, to have our commerce blocked. We have had, it is true, over twenty years' experience of the one pass, and have never been absolutely blocked to the extent that the pass had been seriously damaged, and that would seem to be a satisfactory answer to our fear that the present pass will, or may be, blocked and rendered utterly useless to our commerce for a long period.

Until the last few years that pass has been more than ample for the needs of commerce. Within the last few years, and only then, has there been any absolute pressing need for a deeper channel. For fifteen or eighteen years past the vessels using that channel have required no greater depth than was provided there; but a revolution in shipping has been taking place, and vessels 500 feet long and of 30 and 32 feet draft are no longer the white elephants of the trade, but are becoming the average. The smaller vessels are altogether obsolete, and therefore as the size of the vessels increase, so does our ratio of trade increase, and I say emphatically, from twelve years' experience in this port, that our present risk is one hundredfold more than fifteen years ago. In relation to this, I wish to read to you the actual experience we had last summer:

"The vessel I refer to is the steamer *Jamaican*—a small vessel, not as large as some vessels trading here. This was the experience of the steamer *Jamaican*, one of the regular line traders out of this port, as detailed to the agent of the line by the captain himself:

"'Steamship *Jamaican*, one of the regular line traders out of the port of New Orleans, left the city on the 7th of May, 1898, with a cargo of grain and cotton and a number of first-class passengers, for the port of Liverpool. She was drawing 23 feet 2 inches forward, 24 feet 10 inches aft. When she reached the head of the South Pass she found that the channel had silted a few days previously, and the pilots advised that it was impossible for the vessel to get out. She accordingly anchored at the head of the pass until the morning of May 10, three days later, and the captain's report to his agent is as follows:

"'SIR: After sounding the channel this morning I attempted getting out to sea with the assistance of the tugboat *W. G. Wilmot*, but stuck fast on the first bank, parted my new 9-inch hawser, swung around and knocked down part of the channel wing dam, bending in one of my plates and nearly capsizing the ship, flooded my saloon and passengers' baggage, and doubtless did considerable other damage below, of which I at present do not know. I sent my passengers for safety up to our steamship *Mexican*, which vessel was still lying at the head of the pass awaiting water, my ship lying at an angle of 28 degrees. The firemen, refusing to stay below, had to draw the fires on one boiler to prevent explosion. At 10 p. m. vessel swung stern downstream and came upright a little. Quite a relief. At 2 a. m. canted to eastward. Six a. m. bad as ever. Another tugboat wanted immediately.'

"This vessel lay in an exceedingly dangerous condition from May 10 until May 15, the agent having to send down four tugboats and a large force of laborers and lighters to lighten the ship before she finally floated, and on the 15th instant was brought once more to the head of the pass. She ultimately got to sea safely on May 19 at 8 a.m., having occupied from May 7 to May 19 to make the trip of 110 miles from the city of New Orleans to deep water in the Gulf of Mexico, and having in the meantime incurred an expense to underwriters and owners of some $7,000.

"At the same period a number of vessels drawing more or less water than the *Jamaican* lost a great deal of time and got ashore in the pass, while small vessels of light draft found the channel blocked by these vessels ashore and ran great risk of collision in passing in or out. The experience of the *Jamaican* is by no means unusual, and the trade of the city of New Orleans has been and is in imminent peril at all times from such unseen but probable accidents in the long, narrow pass, which is at present the only navigable exit between the great Mississippi and the Gulf of Mexico.

"The *Jamaican* drew only 24 feet 10 inches, and is, comparatively speaking, quite a small vessel for the trade to the United States ports, the owners of this vessel having, in their own line, vessels twice her size and capacity, and there are other vessels trading to the States with nearly three times her capacity.

"If, therefore, the channel between the Mississippi and the Gulf of Mexico can not be relied upon for the safe navigation of small vessels and light draft, it is very easy to understand that the trade which naturally finds its exit from the Mississippi Valley and the West and Southwest grain districts is most seriously handicapped, doubtless at the expense of the producers.

"Beyond that comes the question of what would occur if the *Jamaican* had capsized or had turned bottom side up right in the pass. There is but little doubt that it would have meant the destruction of the pass and of all the commerce which passes through it. We never know when that will actually take place. As, unfortunately, New Orleans is more of a port than anything else, it is not difficult to see what such a result would mean to the masses of the laboring men in this city. Their living is entirely dependent upon the work obtained from this export traffic, and hundreds would suffer the pangs of hunger and want were such a thing to occur. But outside of the question of transportation affecting the producer in the West and the farmers in the West, to whom the question of a cent a bushel on grain is a serious question—outside of that, there is a local question in addition to the matter of the laboring classes of New Orleans. I feel, and my fellow-citizens feel, that we never know when this catastrophe will come upon us, and we beg of you to push this matter to the utmost and give us a report, so that, if possible, we may go before this very next session of Congress and say to the River and Harbor Committee whether the work could or could not be done, and that if the pass were to cost even $10,000,000 or $12,000,000 the economy and absolute benefit that would result to the West and Southwest would be ample reason for the expenditure. We ask you to help us expedite this work, so that we may bring our work to bear as early as possible upon Congress itself."

Maj. B. M. Harrod, upon being introduced, spoke as follows:

"I speak with great diffidence, because I am very sure that the aspects of the question which I would have to broach are in hands that will give it absolute attention and absolutely the best treatment, so any discussion of the engineering features of the question I do not think is very valuable on this occasion. I have asked Mr. Sanders if he desired me to say anything, and he said that he did and that he would put the opportunity as early as possible, as I have to leave town to-day.

"Another thing that makes me diffident is that I have not had an opportunity of seeing the results of the pass survey. I am simply in possession of the past history of Southwest Pass and other passes. What information I have had of that character has led me to conclusions which I would like to state and ask you gentlemen to consider carefully. One is that observations of Southwest Pass have shown that its energy and velocity is greater than those of South Pass. I long ago reached these conclusions, and I was informed by Mr. Ockerson, who made the survey of Southwest Pass, that the indications were that the energies and velocity of Southwest Pass, notwithstanding its lesser slope, were higher than in South Pass. I therefore think that with the energy available there can be no doubt of the engineering practicability not only of what Mr. Sanders has reasonably demanded for commerce, but perhaps more.

"Another thing that my familiarity with the mouth of the river has impressed upon me is the experience we have acquired with South Pass—the experience we have acquired with the progress of the bar. Twenty years ago, when the matter of entering into contract with Mr. Eads was up, the principal question debated was the ratio of advance, and the predictions at that time went from over 2,000 feet a year down through between 600 and 700 feet to the actual estimate of progress to 100 feet a year. That was made by the last commission which recommended that the jetties be tried. That Board also stated that this 100 feet a year would require an extension of the jetties of 1,000 feet in ten years.

"Now, we know that at South Pass there has been an extension of the bar, but not even so much as the smallest estimate made at that time. Taken altogether, from the 20-foot curve to the 30-foot curve, the advance has been —— feet. Taken altogether, the advance has been less than 150 feet. This is the general advance of the bar, but with that has not come the necessity of extending the jetties. The bar has advanced, but the jetties have cut open a channel through the bar. No man can say to-day that an extension of the jetties is absolutely necessary for that purpose. You can not say when it would be necessary. The bar has advanced less than any man thought. You have had your 30 feet kept up with a minimum of dredge work right through the bar to the sea. This condition existing at South Pass I do not think will be confined to that pass. They exist to the same extent at Southwest Pass.

"As regards cost, I have never had any occasion to give it much thought. I have had no official connection with the mouth of the river below the Head of the Passes, and of course I have received only general impressions, which need correction by information concerning this survey, but I have generally assumed that these jetties would entail a cost of probably twice what South Pass jetties did. I assume that that would be a reasonably safe speculation to make. The present jetties at South Pass cost, I think, in the neighborhood of $3,000,000 or $3,500,000. I should think that double that amount would be a safe estimate.

"The cost of material has been greatly diminished here. Brush, which has been largely used, would remain the same except in transportation, but in stone and concrete the reduction would be very great. Major Quinn knows that he has a large contract for concrete, at $3.37 per cubic yard, which anyone would not have supposed possible a few years ago. The cost of stone has been tremendously reduced, mainly by railroad facilities and competition, so that it can now be bought for $2 per ton. The Eads concrete and stone cost much more. Say that with double the amount of work and with lesser rates of transportation and material, without exact information, I should expect that double the net cost of the present jetties for the building of the Southwest Pass jetties would be covered by $5,000,000 or $6,000,000.

"I say all this with great diffidence, because I know you are so competent yourselves and have so much more information at hand than I have. But one point I wish to reiterate is the excess of energy in Southwest Pass, which ought to be able to do anything you call upon it to do, and in regard to which there need to be no apprehension."

Colonel **Robert**. Have you any additional information upon which anyone could base an estimate for stone at $2 per yard?

Major **Harrod**. In the concrete I am using, a large quantity of it is made with lake shells and I am entirely satisfied with the result. My first experience was with the United States Engineers at Fort Livingston, and concrete work was done there which I have never seen equaled since, all of which was made with shells at an immense economy. Shells are here in immense quantity, and there is no need of bringing stones here. Our stone contracts for work in this neighborhood I think average from $2 to $2.25, and about here we are getting it for a great deal less, say, $1 to $1.25, through barge transportation down the Arkansas River.

The address of Mr. G. Locke Breaux, president of the New Orleans Board of Trade, was as follows:

"I have listened very attentively to the gentlemen who have spoken, and they have presented the matter so exhaustively that I feel there is nothing further to say. We feel that this question is of vital interest, not only to New Orleans, but the entire Mississippi Valley as well. We wish to concur in all the gentlemen have said, without trying to add anything to their remarks."

Capt. A. K. Miller, president of the New Orleans Chamber of Commerce, spoke as follows:

"Mr. Chairman, I am not only here as a member of the committee for the improvement of the mouth of the Mississippi River, of which Mr. Sanders is our able chairman, but on behalf of several members of the chamber of commerce, who are also present to-day, of which body I have the honor to be the president. These gentlemen have come here to-day, many of them by appointment, others unsolicited, so great is the interest in this work.

"As the president of the board of trade has just remarked, Mr. Sanders's able remarks can scarcely be added to. Everything in the volume of his remarks can be summed up in one sentence, that the present pass is insufficient.

"I not only speak as the agent of steamships, covering the last twenty-six years, but also as a former navigator of Southwest Pass and Pass a Loutre. I have watched the growth of the improvements in the mouth of this river since boyhood, therefore I feel more than interest in its success.

"Such a calamity as happened to the *Jamaican*, as Mr. Sanders remarked, is liable to take place at any time. It is the unexpected which happens, and if one of those long ships ever gets athwart the jetties of South Pass, the cost of constructing jetties at Southwest Pass is hardly to be considered compared to the losses of the whole productive output of the Mississippi River, as a consequence of having that pass blocked for fourteen days, so great is the increase of exports from our port.

"Therefore I hope that you, gentlemen, who are honorable and fair-minded men, and as engineers of the United States Army, whose record is so well known, may find it within your province to recommend this great work. We heard the theory advanced in the incipiency of Captain Eads's work that it would be necessary to construct those jetties annually to carry the curve seaward. We hope that you gentlemen will not find that the same conditions prevail at Southwest Pass in that respect. We hope that you will find that it is practicable to construct jetties there, as we urgently require an open highway to the sea.

"Touching upon the naval aspect of the question, I expressed myself pretty thoroughly upon that score before the Committee on Naval Affairs regarding the Algiers dry dock. There is not another port on the entire Gulf that is fit to receive a modern ship of war except New Orleans. Salt water, as we know, deteriorates steel and iron, of which ships are constructed, but fresh water contains animalculi, which destroy and neutralize such effects. Furthermore, this port is safe from the guns of an enemy, whereas they might easily bombard Galveston, Ship Island, and other places along the Gulf coast. Therefore it is quite as important from a naval standpoint that we have sufficient water here to receive our ships.

"I do not know that I can add anything more. We leave the matter in your hands, and sincerely trust that we will be favored with what we ask for."

In conclusion Mr. Sanders made the following remarks:

"I have nothing further to say, except that we leave this matter in your hands with a great deal of hope and confidence. Please believe that the urgency we have stated for immediate action in this matter actually exists, and that we have not exaggerated its importance one single atom."

No other one present desiring to make any statements, the meeting then adjourned at 12 o'clock noon.

Dan C. Kingman,
Major of Engineers, Recorder.

G.

Survey and Improvement Southwest Pass, Mouth Mississippi River.

[Arguments in support of petition to Congress for the opening of a channel of not less than 35 feet through the Southwest Pass, respectfully submitted for the consideration of the Board of United States Engineers appointed to make the survey.]

Copy of statement and petition presented by Capt. J. W. Bryant before the House Rivers and Harbors Committee, Washington, D. C., January 11, 1898.

Mr. Chairman and Gentlemen of the Committee: We are here as a delegation of business men from the Ohio, the Mississippi, and the Missouri valleys, who have left our business and our homes at this time and come a long way to appear before this committee to acquaint you with our serious, pressing need, and to ask your favorable action thereon. Many of us who are present to-day were here last January to tell you of the destructive crevasse in Pass a Loutre, at the mouth of the Mississippi, that threatened the destruction of the other passes. Fortunately at that time we were able to convince you, and through you the House, of the seriousness of the situation, and a prompt and generous response was the result. That crevasse is now being rapidly closed, and soon will be a thing of the past. But, Mr. Chairman, you will remember we also told you at the same time that the Eads jetties, the only channel from the river into the Gulf, had become entirely insufficient for the needs of the commerce and the greater ships that were increasing so steadily and largely, and that soon we would again be here seeking more relief at your hands.

In 1879 a Board of United States Engineers were appointed to report upon the proposed modification of the width and depth of the pass, and they reported that in their judgment a depth of 26 feet was sufficient for all requirements. To-day we have vessels plying regularly to the port of New Orleans that would come in loaded 30 feet deep if there was water sufficient to accommodate them.

Before the construction of the jetties in 1872, 1,371 steam and sail vessels arrived at the port of New Orleans, with a registered tonnage of 1,825,483 tons, and the exports of cotton amounted to 974,761 bales; of bulk grain, 1,079,887 bushels. In 1879, 996 vessels came, of a tonnage of 983,996, the exports amounting to 1,398,124 bales of cotton and 7,581,462 bushels bulk grain. In 1887 the vessels numbered 1,078; tonnage, 1,200,896 tons; cotton, 1,655,347 bales; bulk grain, 14,111,493 bushels, while in 1897 (November 30) the vessels arriving numbered 1,278, with a tonnage of 1,903,100 tons, the export of cotton amounting to 2,028,431 bales; bulk grain, 35,829,143 bushels.

Before the construction of the jetties the largest vessels entering the port registered 2,832 tons. In 1879, the time when the engineers said the channel would answer all requirements, the largest vessel entering registered 3,116 tons. To-day the largest vessel is registered at 5,407 tons, or 12,000 tons dead weight, and there are seven other vessels averaging 4,717 tons, nearly half as much again as the largest vessel entering during 1879. And there are two other steamers nearing completion larger in size and carrying capacity than the largest vessel now coming to this port.

The largest cargo of cotton carried before the jetties was 7,051 bales. Last October a steamship sailed from New Orleans with 23,814 bales of cotton, 2,265 tons bulk grain, and other cargo, and was yet 3,000 tons short of her load, because of the narrow, insufficient channel through which she had to pass to the sea. Before the jetties, in 1872, the exports and imports (at present values of cotton and corn) amounted to a total of $63,700,735. In 1879 they amounted to $89,215,673, while last year the total value of the exports and imports had increased to $114,509,795, this applying to the foreign trade only, and not including the traffic with New York and other coastwise points. In 1872 the lowest rate on cotton was 1 cent per pound; grain, 28 cents per bushel, while recently cotton has been carried across the ocean for as low as a quarter of a cent per pound and grain at 3 cents per bushel.

In a statement submitted by Mr. E. L. Corthell, when the Pass a Loutre crevasse matter was being considered, it was shown, in evidence of the great benefits from the jetties in the development of commerce, there had been a phenomenal increase in the mileage of the railroads into the port of New Orleans, a tremendous increase in the amount of traffic, and a great reduction in rates of transportation; and though it was stated in this same paper there had been far from a corresponding increase in the steamboat tonnage on the rivers, the facts are, as shown in the sworn statements of the United States inspectors, there were 496 more steamers in 1897 plying the Mississippi River and tributaries than in 1872, and 375 more than in 1879, the tonnage being more than proportionately increased.

It will be found that the conditions of the steamboats and the steamships are alike, for in face of all impediments the steamboat is still the factor in fixing transportation rates to the seaboard, whose influence in that direction is limited only in the need of better low-water navigation. And so with the steamships, for despite the too-narrow, too-crooked channel, that full loads can not be taken, and notwithstanding the not infrequent grounding of ships (data which I here submit showing the grounding of 9 vessels in the sea entrance to the pass, 18 in the jetties proper, and 6 in the entrance from the river), as against all this, the ships go on increasing in numbers and size. In consequence of all this, the great commercial, steamship, steamboat, and railroad interests have joined in a memorial to Congress which reads as follows:

To the Senate and House of Representatives of the United States in Congress assembled:

At a conference of merchants, importers, exporters, railroad men, steamship agents, steamboat owners, and others, held at the New Orleans Board of Trade on October 27, 1897, to consider the recognized inefficiency of the South (jetty) Pass for the uses of the large modern vessels regularly trading with this port, many of which can not take full cargoes owing to the insufficient depths of water furnished under present contract requirements, and to impress upon the Government the need of a greater commercial highway for the port, and of the Missouri, Ohio, and Mississippi valleys, as declared in the proceedings of the several recent conventions held in Salt Lake City, Utah, Davenport, Iowa, and Evansville, Ind., it was decided to ask of Congress: First, the expansion of the present jetty channel to its greatest practicable capacity in accordance with the recommendations made by the United States engineer in charge; second, a survey of the Southwest Pass, with the view of restoring that largest of all of the passes to the uses of commerce.

The conference, believing that the many and vast interests involved call for and will justify prompt action, appointed a committee to present and urge before Congress the following resolution, indorsed by the various undersigned interests:

"The growing commercial necessities of the city of New Orleans, which is already the second port of the United States in point of exports, and the entire Mississippi Valley, of which it is the natural outlet, demand that it should be provided with a certain, permanent, and better channel to the Gulf of Mexico. This increase which of late years has taken place in size and carrying capacity of ocean-going vessels, has made the outlet through the Eads jetties wholly insufficient to meet the demands of commerce. Inasmuch as the Eads contract will shortly expire, we urge upon Congress the pressing importance of immediately deepening and widening the channel through the South Pass, so as to accommodate the largest ocean vessels. In our judgment, the great and growing importance of this port makes necessary a navigable channel of at least 32 feet through the present South Pass, and in order that there be no interruption to ocean traffic, we urge that a survey be made of the Southwest Pass, which is the best natural outlet, with a view to improving the same, so that it may also be adapted to all possible demands of ocean commerce."

B. D. WOOD,
Chairman General Conference.
HY. H. SMITH,
Secretary General Conference.

Isaac Levy, acting president New Orleans Board of Trade, Limited.
Felix Couturie, president New Orleans Cotton Exchange.
N. O. Maritime Association, M. J. Sandèrs, president.
N. O. Stock Exchange, Ed. Eisenhauer, president.
Mechanics, Dealers and Lumbermen's Exchange, Geo. M. Leahey, president.
N. O. Produce Exchange, Sam. Blum, president.

La. Sugar and Rice Exchange, J. C. Murphy, president.
N. O. Bureau Freight and Transportation, Limited, Geo. A. Williams, president.
N. O. Board of Underwriters, Geo. Mather, secretary.
Chamber of Commerce and Industries, D. M. Kilpatrick, acting president.
N. O. Fruit Dealers' Exchange, C. K. Browning, acting president.
La. Construction and Improvement Co., C. K. Burdeau, gen. man.
Merchants and Employers' Association, E. Curtis, acting president.
Steamboat Captains and Owners' Exchange, C. P. Truslow, president.
Board of Commissioners, Port of New Orleans, Hugh McCloskey, president.
City of New Orleans, Walter C. Flower, mayor.
Alex. Harris, agent Cromwell Steamship Co.
Chas. F. Orthwein & Sons, Wm. P. Ross, manager agents.
Head Line, Forenede Gulf Baltin Line.
Orthwein Gulf Ports Line.
Elder, Dempster & Co., steamships, M. R. Warriner, agent.
A. K. Miller & Co., agents.
Cuban S. S. Line.
Glynn S. S. Line.
Hecla S. S. Line.
Hoult S. S. Line.
West India and Pacific S. S. Co., Ltd., M. J. Sanders, agent.
Meletta & Stoddart, steamship agents.
S. V. Fornaris & Co., agents French S. S. Line.
Geo. W. Kelly, steamship agent.
Hall & Robinson, steamship agents.
The New Orleans and Western Railroad Co., Chas. W. Towsley, gen. agent.
Robt. Strong, gen. agent Texas and Pacific Railroad Co.
New Orleans and Northeastern Railroad Co., by C. C. Harvey, pres.
Chas. Marshall, supt. Louisville and Nashville Railroad Co.
Illinois Central and Yazoo and Mississippi Valley Railroad Co., by Hunter C. Leake, general agent.
The Independent Coal and Contract Co., Ltd. (Stevedoring), by J. B. Honor, manager.

Personally appeared before me John W. Bryant, to me personally known, who, being duly sworn, deposes and says that the above is a true copy of the original now in his possession.

[SEAL.] CHAS. J. THEARD, *Notary Public.*

NEW ORLEANS, *November 15, 1897.*

Adopted by the Trans-Mississippi Commercial Congress, Salt Lake City, Utah, July 14–17, 1897:

"*Resolved,* That the phenomenal increase in size, draft, and carrying capacity of ocean steamers, and the present proportions of traffic and its wonderful increase, makes imperatively necessary a larger, better channel through the mouth of the Mississippi River to the Gulf of 32 feet at mean low tide and 500 feet wide its entire length. This congress urges that the Government shall make every proper speedy effort to that end."

Adopted by the Convention on the Improvement of the Western Waterways, in Davenport, Iowa, October 6 and 7, 1897:

"The growing commercial necessities of the city of New Orleans, which is already the second port of the United States in point of exports, and the entire Mississippi Valley, of which it is the natural outlet, demand that it should be provided with a certain, permanent, and better exit to the Gulf of Mexico. The increase which of late years has taken place in the size and carrying capacity of ocean-going vessels has made the outlet through the Eads jetties wholly insufficient to meet the demands of commerce. Inasmuch as the Eads contract will shortly expire, we urge upon Congress the pressing importance of immediately deepening and widening the channel through the South Pass, so as to accommodate the largest ocean goers. In our judgment, the great and growing importance of that port makes necessary a navigable channel of at least 32 feet, and in order that there may be no interruption of ocean traffic, we urge that a scientific and careful survey be made of the Southwest Pass, which is the best natural outlet, with a view of improving the same, so that it may also be adapted to all possible demands of ocean commerce."

Adopted by the Ohio Valley Improvement Association, in convention at Evansville, Ind., October 13 and 14, 1897:

"The commercial and transportation interests of the port of New Orleans having declared the present channel at the mouth of the Mississippi River insufficient for the needs of commerce and of the great ships coming to the port, and in order that the interchange of products with the Ohio Valley and the markets of

the world may be protected from any consequent hamperings and interruption, we therefore urge upon Congress the propriety and necessity of providing for the extension and deepening of the present jetty channel as may be recommended by the United States engineer in charge."

INDORSEMENT OF EXCHANGES.

Mississippi: Board of Trade, Vicksburg, E. C. Carroll, president; Cotton Exchange of Vicksburg, S. P. Metzger, president.

Tennessee: Merchants' Exchange, Memphis; Cotton Exchange of Memphis.

Illinois: The Board of Trade, Cairo, P. W. Barclay, secretary; E. A. Smith, president; W. P. Halliday; N. B. Thistlewood, mayor Cairo, Ill. [SEAL.]

Board of Trade of the City of Chicago, Zina R. Carter, president. [SEAL.]

Approved and indorsed by the board of directors of the Merchants' Exchange of St. Louis, George H. Morgan, secretary; H. F. Langenburg, president. Approved by Hy. Gugenheim, mayor. [SEAL.]

Approved and indorsed by the board of trade of Kansas City, Mo., E. D. Bigelow, secretary; L. M. Miller, president; James M. Jones, mayor Kansas City, Mo. [SEAL.]

Indorsed by the Illinois Central Railroad Company, J. T. Harahan, second vice-president; Kansas City, Fort Scott and Memphis Railroad, by Edward S. Washburn, president.

Atchison, Kans.: F. M. Baker, president The Greenlief-Baker Grain Company; S. R. Walker, Elevator A.

Nebraska: Investigated and indorsed by the Commercial Club of Omaha, November 25, 1897, J. E. Utt, secretary; Frank E. Moores, mayor of Omaha, Nebr., Thanksgiving day, November 25, 1897.

Iowa: Indorsed and approved by the Keokuk Business Men's Association, Keokuk, Iowa, this 26th day of November, 1897, Hazen I. Sawyer, president board of directors; Arthur H. Moody, secretary; J. S. Root, mayor of Keokuk, Iowa.

Indorsed and approved by the Davenport Business Men's Association, Davenport, Iowa, this 27th day of November, 1897, W. B. Darling, secretary; Wm. P. Bittendorf, president; S. F. Smith, mayor Davenport, Iowa.

Indorsed and approved by the Linehan Railway Transportation Company, Bart E. Linehan, president, Dubuque, Iowa; Dubuque Board of Trade, by M. M. Walker, president; A. P. Gibbs, secretary; T. T. Duffy, mayor city of Dubuque, Iowa.

Approved and indorsed by the Manufacturers and Jobbers' Union of La Crosse, Wis., November 30, 1897, James McCord, president. Indorsed by delegates from the Board of Trade of the city of La Crosse, at the convention held at Washington, December 17, 1896. Their report approved by the board at its meeting held January 5, 1897, and reaffirmed at intervals; P. A. Copeland, president. Indorsed by the city of La Crosse, Wis., James McCord, mayor.

Approved by the Business Men's Association of Evansville, Ind., December 4, 1897, J. R. Goodwin, president; C. J. Murphy, secretary. Approved by the Manufacturers' Association of Evansville, Ind., December 4, 1897, F. R. M. Gleason, president. Approved December 4, 1897, W. M. Akin, jr., mayor Evansville, Ind.

Approved and indorsed by the Louisville Board of Trade, C. C. Mengel, jr., president; James F. Buckner, jr., secretary and superintendent. Indorsed by the Louisville and Nashville Railroad, by S. R. Knott, first vice-president. Chas. P. Weaver, mayor Louisville, Ky. [SEAL.]

Cincinnati, December 7, 1897: Approved by the Cincinnati Chamber of Commerce, by action of the board of directors at a meeting held this day, Wm. McAllister, president; C. P. Murray, superintendent. Approved by the Cincinnati Bureau of Transportation, Jas. J. Hooker, president. Attest, E. P. Wilson, secretary.

Wheeling, W. Va., December 18, 1897: Approved and indorsed by the Wheeling Chamber of Commerce, Hullihen Quarrier, president; Howard Hazlett, secretary. J. R. Butts, mayor city of Wheeling.

Pittsburg, Pa., December 10, 1897: Approved and indorsed by the Pittsburg Coal Exchange, W. W. O'Neill, president. Attest, J. Frank Tilley, assistant secretary. [SEAL.]

The Hudnut Company Corn Mills, situated at Terre Haute, Ind., St Joseph, Mo., Pekin, Ill., Mount Vernon, Ind. Capacity, 30,000 bushels daily. B. G. Hudnut, president.

Adopted by the National Board of Trade, annual meeting, Washington, D. C., December 15, 1897:

"That the large increase in the size and in the number of ocean craft seeking entrance to the port of New Orleans demands increased facilities for reaching the Gulf, and to accomplish this end Congress is respectfully petitioned to take such steps as will secure the continuation and improvement of the jetties in the South Pass after the expiration of the Eads contract, some two years hence, as recommended in the annual report of the United States engineer in charge, and to permit the work to be carried on at once, on the expiration of the contract, until a depth of at least 32 feet shall have been attained in the present channel.

"*Resolved*, That Congress be requested to take such action at its present session as will initiate the work of improving, by the jetty system or otherwise, the Southwest Pass to the Gulf, so as to provide for the continually growing needs of the foreign commerce of the Mississippi Valley, besides protecting and permitting the incoming and outgoing of vessels in the event of obstruction of the South Pass."

True copy.

S. P. TUCKER, *Secretary*.

CINCINNATI CHAMBER OF COMMERCE AND MERCHANTS' EXCHANGE,
Cincinnati, January 7, 1898.

COMMITTEE OF CONGRESS ON RIVERS AND HARBORS,
Washington, D. C.:

The undersigned, delegated by the board of directors of the Cincinnati Chamber of Commerce to act in the matter, support most earnestly the memorial prepared by the executive committee of the general conference on improvement of the channel at the mouth of the Mississippi River, and in behalf of the membership of the Cincinnati Chamber of Commerce do hereby urge upon the House Committee on Rivers and Harbors, and the Senate Committee on Rivers and Harbors, of the Congress of the United States, to give favorable consideration to the questions involved in the memorial herein mentioned.

In our judgment there is no question to be considered by the Congress of the United States at this time of more importance with reference to the industrial welfare of our people than that of provision for the needful improvement of the channel at the mouth of the Mississippi River, the influence of which upon the commerce of our country being far-reaching and of very great significance. It is manifest that prompt and proper governmental action must be had to avert the threatened interference with ocean traffic, by which transportation would be affected to the great prejudice of the productive interests of the vast region concerned.

OSCAR F. BARRETT,
PARIS C. BROWN,
R. W. WISE,
J. F. ELLISON,
F. A. LAIDLEY,
Special Committee.

MEMORANDA.

Vessels, sailing and steamship, which have grounded at the mouth of the Mississippi River, as copied from the report of the United States engineer, from April, 1892, to October, 1897, together with names, dates, draft of vessels, localities, and time of detentions.

1892.

April 5.—Bark *Charles Luling*, inward bound, and drawing 16 feet, grounded about 900 feet beyond and on the line of the west jetty while attempting to enter the jetty channel. Forced shoreward by the winds and currents, this vessel filled with water and was lost.

May.—During the month several steamers were reported to have touched bottom and some to have stopped for a short time in the vicinity of the entrance to South Pass at its head.

May 18.—Steamship *Barbarian*, inward bound, and drawing 25 feet, entered the channel and grounded. Getting off, she again grounded on a middle ground between the two lights at the entrance, losing two days' time.

May 30.—Steamship *Traveler*, outward bound, and drawing 24 feet, grounded in the vicinity of the entrance to the head of the pass. Got off, and, proceeding down, grounded again and was forced against the bank, where she laid helpless until pulled away by tugboats.

June.—During the month four vessels grounded in making the crossing in Goat Island Reach. They were drawing 22½ to 24½ feet. Three were delayed four hours, the other twenty-four hours.

June 14.—Steamship *Akalba*, inward bound, and drawing 23½ feet, grounded 900 feet beyond the entrance at the sea end of the jetties.

August 1.—Steamship *Traveler*, outward bound, drawing 23½ feet, grounded in the entrance to the pass, and lost thirty-six hours' time.

August 18.—Steamship *Dunkeld,* outward bound, drawing 23 feet 7 inches, grounded on a lump as she was entering the pass at its head, and laid there two days before being pulled off. Just after getting in the pass she grounded and lost another day.

1894.

March 12.—Steamship *Loango,* inward bound, and drawing 18½ feet, grounded within 800 feet of the west end of the jetties while attempting to enter the jetty channel, and remained aground thirty-five hours, when she was pulled off by a tugboat.

March 18.—Steamship *Darlington* grounded to the westward of the jetties, near the entrance of the jetty channel, and remained aground twelve hours.

April 19.—Steamship *Miguel Jover,* outward bound, and drawing 24 feet, grounded at the crossing in Goat Island Reach, opposite Dam No. 2; was pulled off by tugs after being aground six days.

May 12.—Steamship *A. C. O.,* outward bound, and drawing 24½ feet, grounded in the pass about 7 miles above the light-house. She was pulled off by tugboats and started to sea, and again grounded 1½ miles above the light-house, at which place she remained twenty hours before being pulled off.

1895.

January 5.—Bark *Marie Vizen,* inward bound, and drawing 13 feet, under sail, and driven by a strong wind, struck a lump. Anchors were at once let go, but were dragged 1,500 feet south of the west jetty light, where she sunk and was abandoned.

1896.

March 20.—Steamship *Montezuma,* outward bound, and drawing 25 feet, grounded in South Pass 1½ miles above the light-house. She was aground five days and was helped off by tugs.

April 25.—Steamship *Iona,* outward bound, and drawing 25 feet, grounded in Grand Bayou Reach. She was alternately aground and afloat for three days within a distance of 2,000 feet, first on one and then on the other side of the pass. She was helped off by tugs.

April 26.—Steamship *Nordhvalen,* outward bound, and drawing 23½ feet, struck a sand lump in Grand Bayou Reach, was turned around, drifted down about 600 feet, and grounded, losing three and one-half days' time. This steamer was helpless and in great peril, but was relieved after much effort by the tugboats.

October 15.—Steamship *Alberta,* outward bound, and drawing 25½ feet, grounded on the west side of the jetties and directly opposite the west light. She was aground four days and five hours.

October 21.—Steamship *Jerome,* outward bound, and drawing 19½ feet, grounded in the pass 2 miles below the head of the pass. Was aground twenty-four hours.

1897.

February 12.—Steamship *Louisiana,* inward bound, and drawing 17 feet, grounded about 1,000 feet beyond the end of the west jetty while attempting to enter the jetty channel. She was aground sixty hours and had to be helped off by tugboats.

April 27.—Steamship *A. C. O.,* outward bound, and drawing 24¾ feet, grounded in Goat Island Reach, and remained aground thirty-six hours.

May 5.—Steamship *Principessa Christiana,* inward bound, and drawing 20½ feet, grounded as she was entering the jetties, and lost seventeen hours.

May 27.—Steamship *Rhaetia,* inward bound, and drawing 24½ feet, grounded in Grand Bayou Reach. She got off in a short time and waited for another tide, and again grounded, but got through after a third attempt and three days' loss of time.

September 11.—Steamship *Gottfried Schenker,* drawing 26 feet, passed out to sea, but putting back on account of a storm, grounded on a shoal as she was entering the jetties just beyond its end. In a short time she was gotten off, and, securing a regular pilot, again attempted to enter, and grounded in about the same place as at first. She was floated three days afterwards with the aid of tugs, and after having jettisoned a portion of her cargo.

October 14.—Steamship *Inchisle,* outward bound, drawing 24 feet, grounded in Grand Bayou Reach, and remained there eleven hours.

GROUNDED SINCE FILING ABOVE MEMORANDA.

December 28.—Steamship *Ramore Head,* outward bound, and drawing 25 feet 2 inches, grounded in Grand Bayou Reach. Steamship *Bernicia,* drawing 25 feet, followed the

Ramore Head, and grounded in attempting to pass by that vessel. On the night of the 28th a tug pulled the *Ramore Head* off, but in helping her on out the *Ramore Head* was again grounded, and lost another day.

December 29.—Steamship *Carolina*, outward bound, and drawing 22½ feet, grounded to the eastward of the channel 1½ miles below the Head of the Pass, but was floated off the next morning.

December 30.—Steamship *Duchess of York*, outward bound, and drawing 19½ feet, grounded at about the same place as did the *Carolina*.

1898.

January 8.—Steamship *Monarch*, outward bound, and drawing 25½ feet, grounded in Grand Bayou Reach, and remained aground four hours.

January 9.—Steamship *Montezuma*, outward bound, and drawing 25½ feet, grounded in Grand Bayou Reach, and remained aground until 12.30 p. m. on January 12, and at 6.30 p. m. another attempt was made to put her through the reach, when she again grounded.

January 11.—Steamship *Breakwater*, bound in, and drawing 14 feet, sheered across the channel in entering, and landed on top of the west jetty, knocking two holes in her and causing her to leak badly. She remained there three days.

January 13.—Steamship *Galiego*, outward bound, and drawing 22½ feet, grounded in Grand Bayou Reach, and lost seventeen hours.

January 15.—Steamship *Montrose*, outward bound, and drawing 24½ feet, grounded in Grand Bayou Reach, and lost twenty-one hours.

January 16.—Steamship *Montezuma*, outward bound, and drawing 24½ feet, grounded in Grand Bayou Reach, and lost twenty hours. After this steamer was floated, on the 13th she was taken back to New Orleans and lightened in draft 1 foot.

January 23.—Steamship *Battiston*, outward bound, and drawing 22½ feet, grounded in Grand Bayou Reach, and lost eleven hours.

February 22.—Steamship *Rhaetia*, outward bound, and drawing 26 feet, grounded in Grand Bayou Reach, and lost three days.

STATEMENT OF MR. M. J. SANDERS.

Mr. Chairman and Gentlemen: In placing before your honorable Board our reasons for petitioning Congress to open up a wider and deeper channel from the River Mississippi to the Gulf, we desire to point out that, as evidenced by signatures to the petition, the interests which call so imperatively for this improvement are in no sense local to any one city, district, or State, but are the interests of the whole valley of the Mississippi and its great tributaries, and even beyond that—the States of the West, that geographically must look to the seaports of the Gulf as their gateway to the markets of the world beyond.

The value to the farmers and manufacturers of this country of deep-water harbors and outlets to the ocean can not easily be overestimated, as it is by such means only that the most economical form of ocean transportation can be furnished, and without this the farmer and manufacturer of the great West, already weighted with a long transportation to the seaboard, can not possibly maintain his position in keen competition with other countries, whose products meet theirs in the markets of Europe, Africa, and the great East.

The question of ocean transportation may be said to be the key to the position in this ceaseless fierce fight battle for the markets of the world. That this country to-day holds a proud position in this contest is largely owing to the wisdom of our Government, which has by its liberal expenditures upon the harbors of the country deepened and widened channels and so improved the navigation of its seaports that this country is to-day enjoying, probably, above any other nation the largest and most economical ocean transportation, and is thus saving millions annually to the producer, which, without these harbor improvements, would have to be paid for this transportation. The country that has trading to its ports the largest class of ocean carriers pays invariably the least for ocean transportation.

As an example of the value of deep-water navigation to the country at large, I will instance the influence upon ocean freights of the 26-foot channel through the South Pass of the Mississippi obtained by Mr. Eads by means of jetties in the year 1879. Previous to that the only outlet from the Mississippi River to the Gulf available for ocean vessels was through the Southwest Pass, which had then only some 18 feet of water on the bar, and therefore vessels requiring a greater depth than this were unable to trade to the port of New Orleans.

Previous to the opening of the South Pass the rate of freight on cotton from New Orleans to Liverpool was about 1½ cents per pound, or $7.90 per bale. Shortly after the opening of the jetty pass in 1880 the average rate decreased to three-fourths of 1 cent per pound, or $3.90 per bale.

In 1896 the average rate on cotton to Liverpool had dropped to three-eighths of 1 cent per pound, or $1.95 per bale. This saving in ocean freight must be computed, not upon the cotton exported from New Orleans only, but upon the whole export of cotton from the country, as each port is in strict and close competition with the other, and produce seeks the most economical route. The saving to this country through the decreased cost of ocean transportation on cotton alone in sixteen years has been over $100,000,000. On grain the saving has been still greater. In 1880 the average freight rate on grain had decreased from 30 cents to 14¼ cents per bushel, New Orleans to Liverpool.

In 1896 this rate went down to an average of 8¼ cents per bushel, or a decrease of 6 cents per bushel.

The same identical competition comes into play on grain as on cotton, and therefore the decrease at one port is found in all competing ports. The exports of wheat and corn and their products in sixteen years, from 1880 to 1896, amounted to 3,453,000,000 bushels. If an average decrease of only 6 cents per bushel be figured, the saving in ocean transportation has been over $207,000,000. This economy is directly and absolutely the result of better harbors and deeper navigable channels enabling larger ocean carriers to be built, which, owing to their irresistible economy, are enabled to-day to carry freight from America to Europe at one-third the rates obtainable sixteen years ago, with equally good net results to the owners.

Congress has expended upon river and harbor improvements since the Declaration of Independence a total of some $250,000,000, and the country has been enabled to save far more than this total upon only three products of export in the item of ocean transportation only during the past twenty years.

Gentlemen, it is almost impossible to exaggerate the value to a country such as this of deep navigation. The very existence of the toilers in the great West depends upon their use of the cheapest and most economical form of ocean transportation, and a difference of but 1 cent per bushel for the transportation of grain, means annually millions of dollars. Without deep water the largest form of ocean transportation is not available, and as a draft of 25 feet is the deepest to which a vessel may now safely load to pass from the river Mississippi to the Gulf, there are already some 45 modern ocean vessels trading to the port of New Orleans that are unable to load full cargoes of grain, and are obliged to leave our trade and seek employment elsewhere when light freight, such as cotton, is unobtainable. All such loss of capacity is sooner or later borne by the producer, not by the shipowner, and one evidence of such loss will serve to illustrate: The steamer *American* sailed from New Orleans September, 1897, drawing 25 feet 11 inches and carrying 288,000 bushels of grain, no cotton or other lighter freight being obtainable. Her freight list was $23,400, but owing to insufficient water in the pass she was unable to carry a full cargo, which would be 372,000 bushels, a clear loss of 84,000 bushels capacity. The ship-owner would have netted the same earnings at nearly 2 cents per bushel less freight than he did obtain had his vessel been able to carry a full cargo.

There is probably no commercial commodity so strictly competitive, so immediately responsive to the inevitable law of supply and demand, as the rates of ocean transportation, particularly from the United States ports. This insures to the producer the full saving in the economy of large versus small carriers. This fierce and constant competition is the essential cause of the continuous increase in the size of the ocean carrier, which in the past decade amounts almost to a revolution. Even ten years ago the largest vessel leaving New Orleans for Europe carried less than 4,000 tons' weight of cargo and less than 10,000 bales cotton. To-day we have a number of vessels trading to the port with a capacity of 12,000 tons dead weight (which, unfortunately, owing to lack of deep water, they are unable to make use of from New Orleans), or in light freight of nearly 30,000 bales cotton.

The port of Liverpool, the home of modern shipowners and justly celebrated for its magnificent system of docks, which to-day is capable of accommodating the largest vessels that float, fully laden, has perfected plans and decided upon an immediate expenditure of $17,500,000 in widening dock gates and deepening entrances, etc., to accommodate vessels of 900 feet length, 90 feet beam, and 40 feet draft. Such vessels as these would have an economy probably three times as great as the largest now trading to our port. We can not yet accommodate even the latter class of vessels, and are apparently not yet thinking of those likely to be built in the near future.

I have tried very briefly to show the enormous saving to the country through the increased capacity of the ocean carrier up to the year 1896. We have not yet realized the full benefit of the increased capacity in the vessels of past two years, and can not until this capacity can be fully utilized. What of the coming economy, for which the port of Liverpool is already preparing? This question, gentlemen, we consider most vital to the interests of the whole country, for upon it depends the welfare of the millions of the Western States; its importance commercially can not be exaggerated.

From the standpoint of national defense as a harbor for the Navy of the country, others will treat the subject. I will simply say that with a 35-foot channel through the Southwest Pass we consider the Mississippi River with its hundreds of miles of deep waterway, its unrestricted communication and certainty of supplies, provides one of the most magnificent harbors in the world.

We have petitioned Congress for a 35-foot channel; in the near future the commerce of the country will probably require still more. We commend the whole matter to your careful consideration, trusting that your investigations will enable you to recommend such improvements to the mouth of the great river as will insure to the producers of this country the most economical form of ocean transportation. This will enable the great West to overcome the serious handicap of its great distance from the seaboard and maintain its position as a competitor in the great markets of the world beyond the seas

STATEMENT OF MR. W. P. ROSS.

On behalf of the New Orleans executive committee, now working for improvement at the mouth of the Mississippi River, I desire to lay before you their reasons for believing that South Pass is inadequate under the utmost possible or practical improvement to provide the necessary channel for the most economical tonnage of the present day, and unquestionably so for the tonnage which will be the ocean carrier of the near future years. We might say that no better confirmatory evidence is wanted than the fact that New York, Boston, and such leading European ports as Liverpool are reaching out to provide channels 35 feet deep and of sufficient dimensions otherwise to accommodate steamers 900 to 1,000 feet in length and 80 to 100 feet beam. Twenty five years ago (when the present jetty channel was planned) we knew comparatively little of what was possible in the development of ocean tonnage. Then a steamer 300 feet long was a large steamer and there were few as high as 40 feet beam and still fewer drew as much as 25 feet of water; furthermore, it was then supposed that the contract for the jetties called for a channel 30 feet in depth, and even when it was modified to 26 feet the alarm was not taken. In fact, people knew of that modification, while probably no one outside of the contractors themselves realized that the 26-foot channel provided was, from the plane of mean high tide, subject to shoaling fluctuation through wind and tide, as in ascertaining the contract channel, as we understand soundings are taken from the plane of mean high tide—that is, from a point or bench mark fixed, which might be 3 feet above the surface in the air. There may be only 23 feet at neap tides, with north winds blowing at the point of mean high tide, instead of 26 feet water, which the Government engineers are bound by terms of contract to certify to.

It is probable, had these facts been known or understood, Mr. Eads's contract would have read so that a minimum channel of 26 feet would have been assured at all stages of tide and wind. Even this would have been inadequate for the present economical freight carrier now in the trade, such as the *European*—475 feet long, 55-foot beam, requiring a channel of 32 feet, of ample width for safe and easy navigation. By safe and easy navigation we mean that a ship which will draw 30 feet on even keel in salt water will require 30 feet 7¼ inches in fresh water; that nine ships out of ten would be trimmed 1 foot or 18 inches by the stern, and further require at least another foot of water under their keel, even in the jetties, where there is no chance of swell or sea. A ship, therefore, drawing 30 feet of water on even keel in salt water, or 30 feet 7¼ inches in fresh water, will trim in fresh water 30 feet forward and a little over 31 feet aft. As the *European*, *American*, *Milwaukee*, *Montrose*, *Monmouth*, *Montcalm*, and *Monarch* are ships of this class, it needs no further argument to show that the present jetty channel, even if improved to 30 feet, would be barely equal to the most economical freight carrier now in the New Orleans trade. That it is not equal to the modern freight carrier, with which New Orleans has to compete, is shown by the fact that the steamship *Cymric* is 599 feet long, 64-foot beam, and 38-foot depth of hold, while the *Kaiser Wilhelm der Grosse* is 625 feet long, 66-foot beam, and 43-feet depth of hold, while still larger steamers are in course of construction. A channel of 32 feet in depth would therefore be inadequate for steamers actually in existence, much less to the still larger ones which will doubtless be built during the near future, and which will be able to carry cargoes still cheaper than at present. That these will be built is undoubted, if only from the fact that competition among the various freight carriers will unquestionably cause a response to the demand for more economical transportation wherever facilities are provided for the larger ships necessary. Shipbuilders all agree that economy in construction depends upon the depth and length of the boat; that increase in beam of the vessel, where lighter draft may be had, adds to the cost of construction considerably out of proportion to the added cost of making the ship deeper and longer.

Another practical reason why shipowners object to a channel where they are liable to strandings, collisions, etc., is from the fact that every such accident means an expenditure of large sums of money. The stranding of the *Barbara* involved a loss to the ship and cargo of over $100,000; but, at the least, every stranding involves detention.

The usual method of reckoning detention is at 8 cents per ton, net register, per day; the *Milwaukee*, carrying 27,000 bales cotton, is 4,755 tons net, which at 8 cents per ton is nearly $400 per day. The interest on her cargo at 5 per cent runs to nearly $30 per day. In addition to this towage expenses are incurred in almost every case of touching the ground, ranging from $500 to $10,000 or $15,000, as towboats for this service charge (according to size) from $20 to $30 per hour, and sometimes three or four tugs are needed; besides this, every vessel stranding blocks others from coming in and going out. It is not an overestimate to say that recent strandings, commenced by the *Ramore Head* about six weeks ago, cost in detention, towage, and interest a full $100,000, while the consequential damages can not be estimated. We do not know what markets have been lost through delays in delivery of cargo, although these occasionally come to our attention, and one case was brought recently to my attention which cost the receiver on the other side about $1,000 on a small parcel of grain, and doubtless this case is only one of many. Again, the agents loading steamers at this point have been made overcautious by the uncertainty of the steamship getting out, and in many cases have advanced their grain rates to a prohibitive point in order to give preference to cotton and other light cargo. The effect of this reacts through the country, so that although the cause may be unknown, these strandings in South Pass have affected the grain movement, and consequently the prices in the interior.

There is one thing also certain, and it is that you can not put an expense upon a shipowner which he does not in turn impose upon the producer. The shipowner is after net revenue only, and every item of expense—even such extraordinary ones as just mentioned—are practically allowed for in the gross rate of freight which he demands. The underwriter also adds his little mite in the way of increased premiums on the ships and cargo. He, like the shipowner, figures all these contingencies in his rate.

There is a further reason why South Pass is a standing menace to ships inward bound. In thick weather vessels are thrown to the westward through an unmistakable current trending west, past the end of the narrow jetty channel. The consequence is that they get ashore west of the jetties at a point where from various causes a dangerous hard shoal has accumulated. More than one vessel has been lost here and others seriously injured, such as the *Charles Luling*, *Gottfried Schenker*, and *Breakwater*, among many others; the *Gottfried Schenker* contributed 1,000 tons pig iron as her share to this dangerous shoal. At Southwest Pass, with an entrance probably 2,500 feet wide and no shoal to the westward, this danger disappears.

As an example of how shipowners and agents look on these constant strandings in South Pass, I would quote from a letter just received from the managers of the Head Line, whose steamers *Ramore Head*, *Inishowen Head*, and *Malin Head* suffered expense and detention since the 1st of January, as follows:

"We confirm cables exchanged, and note that you have now compromised the *Ramore Head* towage for —— with Messrs. ———, and —— with Messrs. ———. We certainly think that both of these firms have been amply remunerated for their work. Of course we can not pay a sum of this kind out of our own pockets, and are therefore having average bond perfected, and the amount will constitute a general average claim upon the ship and cargo. It is very unfortunate, but can not be helped. We have no doubt whatever that you have done your best to reduce the claim, but all these things tell with us against New Orleans. You can have little idea how it is canvassed here, these continual groundings, heavy expenses, and long detention."

Coming now to the question of width of channel in the navigation of ships, it is manifest that in a narrow channel with a swift current vessels are at any time liable to take a sheer into the bank. Many of the strandings in South Pass have been from this cause; that is one disadvantage of a narrow channel. The next difficulty in a narrow channel is the increased risk of collision. Where we had formerly to deal with ships 35 to 40 feet beam, and only 300 feet long, the present channel was not so far out, but now that we have to deal with ships of 45 to 55 feet beam, and lengths 400 to 500 feet, there is manifestly more difficulty in navigating this same narrow channel, while to deal with ships 800 or more feet in length and 60 feet beam, it is manifest that these difficulties will be again enormously increased.

As examples of what is meant, I would instance the steamship *Barbara*, grounded last year in South Pass during high water, with a 6-mile current running; her propeller and rudder were disabled and twisted out of shape, and it was found impossible to tow her in this condition upstream stern first to the Head of the Passes. Although she is only 340 feet long, and was drawing but 24 feet, it was necessary to drive piles alongside the banks to which the ship could be secured, and then lighten her of 1,000 tons of cargo before she could be winded bound bow upstream. In the case of the *Ramore Head*, 402 feet long (which steamer grounded about a month ago at Grand Bayou), she had to be towed upstream after being floated to the Head of the Passes (about 6 miles) stern first, because she could not turn round and steam up.

There is evident danger in towing a ship stern first against a fast current, and it is impossible if the propeller and rudder are disabled, as was the case with the *Barbara*. Had the *Ramore Head* been so disabled, it would have been necessary to have lightened her and taken her to sea before she could have been turned round and towed back to the city for repairs. This question of turning a ship around in the pass is something liable to be required at any time, especially in a channel 12 miles long, and it is plain that such a feat is not possible unless the channel is as wide as the ship is long; that is, with a ship drawing 30 feet of water, 500 feet long, there should be a 30-foot channel at least 700 feet in width, in which she could be freely turned, and this necessity grows with the length and the depth of the ship. Another reason requiring width of channel is the fact (in which all nautical men agree, although it may be a chestnut) an accident, which will result in the sinking of a vessel, is bound to occur sooner or later. Possibly when this inevitable collision does come there will perhaps be two vessels sunk; it is improbable that such vessel or vessels will lie fair up and down stream, but are more liable to get thwartship, and may occupy pretty near the whole width of the channel, or as much of it as that ship's length will go. Now, a vessel in such a position would speedily so fill herself with sediment that little short of dynamite would be effective, except possibly the slow process of breaking the ship up into pieces and removing her, plate by plate. While dynamite would doubtless blow the ship up it would blow up the channel with it. Such a wreck would completely stop the channel for a twelvemonth, and New Orleans would be so bottled up and ruined for a seaport as if it were at Kansas City.

There is but one effective remedy for this, and it is that the channel must be sufficiently wide for any vessel to be sunk and still leave space on one side or the other for other long, wide, and deep vessels to pass. Under such circumstances even 600 feet width of channel would be hardly sufficient. This is not a fancy sketch, or a false cry of "Wolf," but one which will be borne out by the expectations of experienced seafaring men the world over, with expressions of wonder that it has not occurred before.

Having thus described at length what the ships require and expect (now and in the future) for easy and safe navigation, I would next draw your attention to what we have at South Pass and compare same with Southwest Pass. We take the stand that a channel 35 feet deep and 800 to 1,000 feet wide at the bottom at all stages of the river is necessary for easy and safe navigation. At South Pass we have a channel 12 miles long from the Head of the Passes to the sea end of the jetties; it is about 600 feet wide throughout at the surface, with a nominal channel 26 feet deep and 200 feet wide. At Southwest Pass we have a channel perhaps 15 miles from the Head of the Passes to deep water, but it is between four and five times as wide as South Pass, or 1,500 feet wide throughout its entire length up to about the old pilot station, where it commences to widen out. From this point to the 10-fathom curve in the Gulf it is about 6 miles. From the Head of the Passes to the pilot station the channel throughout runs 40 to 50 feet deep and 800 feet wide at the bottom. The natural conditions, therefore, are that Southwest Pass would have a channel wide enough and deep enough for all purposes; so that with the exception of the necessary works, which are common to both South and Southwest Pass, needed at the Head of the Passes, and the jetty works, etc., at the mouth of Southwest Pass, nothing further is needed for easy and safe navigation through Southwest Pass. At South Pass the conditions are altogether different. The entire channel, 12 miles long, the jetties themselves, and the works at Head of the Passes would all have to be widened and deepened throughout the entire length. Engineers tell us that the banks of South Pass are not strong enough, without widening the pass and strengthening the banks, to support themselves if the channel is deepened to any great extent. As we need a channel 800 feet wide at the bottom, it is necessary to have a channel 1,500 feet wide at the surface and carrying a much larger volume of water than at present. Doubtless the works at the Head of the Passes can be enlarged and widened so that any amount of water can be deflected into South Pass; but what can be done with the jetties themselves? If the pass is widened even for a 30-foot channel 500 feet wide at the bottom, the volume of water that will be necessary to scour out the pass will be so great as to erode a channel through the jetties at least 40 feet deep. It is plain that such a channel would undermine the works, and all the rock and stone, etc., now composing them would slide into and destroy same. The works throughout South Pass from the head and including the jetties were all designed for a channel less than 30 feet in depth; thus, at South Pass, the entire channel, 12 miles long, would have to be widened and excavated, and when it was done there would be a very great risk that the value of the work would be destroyed through this undermining of the jetty works themselves. At Southwest Pass we have none of these difficulties to encounter. We have simply the problem of contracting and extending the banks for less than 6 miles into deep water. Whether there are engineering difficulties about this which would make the work impracticable is something of which we are not competent to speak, but it seems to us a simple question of jettying. The surveys now called for are to establish this fact by competent testimony. We consider that our duty is limited to pointing out to you the difficulties and shortcomings of the present channel and the difficulties we see in making South Pass available for what is now needed and to come.

In conclusion, there is a final reason why the channel into the Mississippi River should be sufficient for the most modern of the world's navy, present and future, and a reason in which the entire country is interested. At present there are few harbors where the larger vessels of the United States Navy could seek refuge in case of overpowering necessity, and none in the Gulf. The Mississippi River itself affords a harbor that can accommodate in single file something like 1,500 of the largest vessels of the world, as in the lowest water there is ample depth in the channel for 200 miles above the Head of the Passes. This harbor is landlocked, and the entrance to it could be obstructed with the greatest ease against the entrance of any foe. In case of war with the countries south of us, or, in fact, with any foreign country, New Orleans would be one of the great bases of operations, provided this channel at the entrance of the river was made adequate. The natural causes, which would even compel this, lie in the fact that it is not only a large city and seaport, where every requisite incidental to military and naval operations can be concentrated, but it is the terminus of the greatest river in the country, and it is also the terminus of the largest number of important trunk lines, not even excepting New York, and as a concentrating point thereby unequaled. It is the only large harbor where ships can lie in fresh water, and is, therefore, par excellence, the best point where the navy held in reserve could be laid up so as to be in such a place that when wanted for service in an emergency they would not require detention in docking, cleaning bottoms, repairs, etc., which matters, while apparently trivial, are very important in actual practice.

STATEMENT OF GOVERNOR D. R. FRANCIS, OF MISSOURI.

Mr. Chairman and Gentlemen of the Committee: I am here representing the Merchants' Exchange of St. Louis, but I come here to protest against this being called local in any sense of the word. The tariff may be a local issue, but the improvement of the Mississippi River and its tributaries and harbors of the Gulf is a question in which every section of this country is interested. During the past twenty-six years I have been in the grain business. All the years of my boyhood and manhood, except a few years by way of diversion in office holding, have been devoted to the selling and buying of grain, and to-day I am engaged in that business. When I laid down the cares of office, on the 6th of March, I immediately returned to the grain business, and I am buying grain and selling grain in Europe to-day. I therefore speak authoritatively as to the improvement of the jetties and its importance to the grain interest of this country. I want to lay down the broad proposition that the action of you gentlemen regulates the price of every bushel of wheat, corn, and oats grown in the United States.

A few years ago Congress appropriated, at the recommendation of this committee, $6,000,000 for the improvement of the harbor of Galveston. Since that improvement has been made there is a sufficient depth of water in that harbor to take ocean steamers of heavy draft. The exports of grain from that harbor have increased from less than 500,000 bushels to over 10,000,000 bushels in 1897. It has also caused the construction of new trunk lines of railroad from Galveston to the grain fields of the West. During the same calendar year 42,000,000 bushels of wheat were exported from New Orleans. I say that the result of the improvement of the Galveston Harbor was the construction of lines of railroad from the grain fields of the West to the waters of the Gulf, and the cost of the transportation of grain over those roads to the Gulf since that harbor has been opened to tide water has regulated the rate of transportation of every bushel of grain grown in the vast fields of the West and shipped to tide water, whether on the Atlantic coast or on the Gulf of Mexico, and whether it went through the canals and the lakes or by trunk lines of railroad it matters not. My own house has shipped since the first day of July last over 3,000,000 bushels of grain to Europe, and all but 97,000 bushels have been shipped from the Gulf.

The price of grain in this country, if any of that grain is exported, is regulated and fixed by the price obtained for the surplus product. The price we obtain abroad is regulated by the competition furnished by other grain-producing countries, and to-day if it were not for the competition in Europe of the Argentine Republic with our wheat, the American wheat being exported to-day would bring at least 10 cents per bushel more than it does. The new Argentina crop is offered in France and Germany and the United Kingdom freely. I left home at 10 o'clock on Saturday, and on that day I sold 56,000 bushels in Germany and 40,000 bushels in France. I therefore think I am in touch with the markets of Europe as well as those in this country. When you bear in mind that the price of these products in Europe is regulated by the competition of other grain-producing countries, you must accept the conclusion that for every half or quarter of a cent per bushel that we reduce the cost of transporting it to these countries, just in so much is the producer in this country benefited.

We raise, according to statistics, 2,000,000,000 bushels—or two thousand million bushels—of corn in this country every year. That is about our average crop to-day. Take 1 cent per bushel on that and it is $20,000,000. According to the statistics of the Agricultural Department, the wheat crop of 1897 will be 530,000,000 bushels. Take 1 cent per bushel and it is $5,300,000. We are exporting oats. The price of oats is regulated by the price realized for the surplus which we export. The average crop is 9,000,000. Take 1 cent per bushel on those three products, wheat, corn, and oats, and it amounts to $33,700,000.

In the States tributary to the Mississippi River and the Missouri 68 per cent of the wheat crop of this country is grown. Seventy-six per cent of the corn crop is raised in States on the Mississippi and its tributaries, and 78 per cent of the oat crop is raised there. We protest against this being called a local issue. Every grower of wheat, corn, and oats is interested in the opening of deep water to the Gulf, because it affects the transportation cost on every bushel of grain grown in this country, whether it be shipped by water or rail to the Gulf.

I returned about the middle of March to St. Louis, after spending six or eight months in Washington in the cares of office. I have a branch house in New Orleans and Kansas City, the parent house being in St. Louis. I found that our New Orleans house had chartered a vessel going to Liverpool and it was unable to load the ship, and we had to resell at a loss of $2,200.

Mr. Morris. Why were you unable to load?

Mr. Francis. Because we were unable to get the grain. If there had been a stock of grain, and if the shipping had been made in the winter months, I should have been able to have loaded at a small loss. The steamer *Barbara* was loaded on the 17th of April for Dunkirk, France. I had 27,000 bushels in a cargo of 225,000 bushels grain. There was also cotton and other freight on the vessel.

The vessel grounded in the jetties was detained there ten days and had to return to New Orleans. All that freight had to be unloaded from the vessel and the vessel repaired. There was a respondentia bond and insurance against the freight, and my portion amounted to between $6,000 and $7,000. I declined to pay it, and it was referred for settlement to the agents. The total respondentia bond was $100,000. The cost of taking that steamer *Barbara* back on the 17th of April, rehandling cargo, and repairing the vessel was $100,000.

Mr. Morris. What was the draft of that vessel?

Mr. Francis. It was 25.8 That boat grounded at the mouth of the jetties. I speak somewhat feelingly of this. I do not know what it will cost before we get through with it. That is only an instance of what might happen every day. We are paying larger ocean freights from New Orleans and Galveston than from Baltimore, Newport News, or New York. Ocean freights are much larger and insurance is much higher from New Orleans, and both of those tend to regulate the rates from the Atlantic seaboard, as Mr. Sanders clearly and forcibly explained yesterday.

So, gentlemen, as a grain man, and one who handles the raw products of this country, I come to you in the interest of both of the great grain-growing sections of the country and ask you to open this deep water to the Gulf. There are men, perhaps, more closely connected with the cotton interest than I am, but what I say applies with the same force to the cotton business. We raise in the West over 75 per cent of the exports of this country. We certainly pay our share of the internal-revenue taxes. The internal-revenue taxes in the city of St. Louis, I believe, are second largest in the United States. It is the largest plug-tobacco manufacturing city in the world. I believe you gentlemen are perhaps better acquainted with the subject than I am, but we are the second largest internal-revenue tax payers in the United States, and, therefore, we think, when we produce the wealth of this country and when we pay a large share of the internal-revenue taxes, which are enough to support the Government if it were not for the pension list, that we are entitled to this consideration. We think it would be generous upon your part to grant this request. We appreciate your liberality in the past, and think we are entitled to this from the standpoint of justice.

I want to make this other point: This great waterway is under the control of the Government, but I say, and I will make myself personally responsible for the statement, that if the Federal Government, which alone has the power, will delegate to me the right to collect toll at the pass, I will deepen it to 30 feet or to 35 feet in the Southwest Pass, and will open it to exports at 1 cent a bushel and 10 cents per bale on cotton, and would make $600,000 a year.

The CHAIRMAN. I have no doubt it would make the deepest harbor in the world.

Mr. McCULLOCH. Do you think the Government would give that privilege to any corporation?

Mr. FRANCIS. No. I would not want to do it if I were a member of Congress or a member of this committee. We want this, and must have it, and it is in your power to give it. I would guarantee to organize a company that would get 30 feet of water at the South Pass or 35 feet at the Southwest Pass if I were permitted to charge tonnage.

Mr. McCULLOCH. For twenty years, even?

Mr. FRANCIS. Yes; for twenty years. It has been shown that 42,000,000 bushels of grain were exported from New Orleans up to the 31st of December. There were also exported 2,248,000 bales of cotton. At 1 cent a bushel on the grain alone, not counting return freights, it would amount to $420,000, and at 10 cents on the cotton it would amount to $204,000, which would make altogether $624,000, or 5 per cent on $12,000,000. You can improve the South Pass to a depth of 30 feet for $1,000,000, and you can make the Southwest Pass 35 feet deep on an expenditure of $3,000,000. Are you going to stand upon this paltry sum when the interests affected are so vast? I have too much confidence in the patriotism and the good sense of the members of this committee to feel that you will refuse to do so.

We come here representing the St. Louis Merchants' Exchange. New Orleans is not alone interested in this. We disclaim the proprietorship of New Orleans in the jetties or in the Mississippi River. We want that great artery preserved for the entire country in order to regulate freights from the interior to tide water, because it affects the rate of every bushel of wheat and every pound of cotton grown in the United States.

I do not know what more I could say to impress it upon you more forcibly than I have already done. If I could say anything more, I certainly would do so, but I know that your time is limited, and I shall therefore be glad to answer any question which you may desire to ask upon the subject.

I want to say in regard to this Eads contract, with which I am not very familiar, but feel that I have some acquaintance with it, that under that contract 26 feet of water must be obtained at the South Pass until the first of July, 1899, and after that time they are to make up any deficiency which may exist. If the Eads estate gets $100,000 a year, that is a small matter. I do not know whether it has spent $20,000 or $200,000 to get 26 feet of water. I say it is immaterial, so far as the magnitude of the matter is concerned. What it has cost to maintain that 26 feet of water I have no concern about, and I think it is a mere bagatelle. What we want is 30 feet of water, and with $1,000,000 appropriated for that purpose it will bring about that end. Suppose a vessel should be sunk in the South Pass. It would mean a loss to my house of $20,000. I sell grain for April, January, and March shipments, and if the market is against me one-sixteenth of a cent it is a very important matter, because, time being such an element in a contract of that character, they will make you pay all they possibly can. I have paid demurrage of thousands of dollars on vessels at New Orleans because they were delayed in getting through the jetties. Think of what it means to the producer. If the producer does not pay that it is not my fault. Of course I am there to protect my interest and the interest of those I represent.

The rates of freight upon the great Gulf ports in the Mississippi Valley and the Missouri Basin transported to tide water are regulated by the rates of freight on the lakes, the canals, and the Atlantic seaboard, and it is measuring the rates of the great trunk lines of to-day. Whenever it suits the railroads to accumulate large stocks of grain in Chicago they do so, and fix the rates accordingly. We do not blame them, but we blame them for making the rate from St. Louis one-sixteenth per cent of the Chicago rate to tide water. We are beginning to feel our oats and to become independent. We have one line of transportation to Newport News which refuses to be regulated by the all-rail rate to tide water. We have other lines to New Orleans and Galveston, and they have refused to be regulated by the Chicago rate, and when the Mississippi River is improved and the grain-producing section of the country has an outlet by the mighty waterways in steel barges they will be the rate regulators of the country. They will not only determine the rate of freight to be charged at Omaha, Galveston, and New Orleans, but will determine the rate which the railroads shall charge. If you do not give us this deep water at New Orleans, you will lessen materially this competition.

I have shown you what has been done at Galveston. Mobile has become a factor, but not an important factor as yet, and will not be until her harbor is improved, when she will be quite a factor in the cheapening of rates.

Grain is being shipped from Charleston, as well as Mobile and Galveston. Pensacola will also soon be an important factor. An elevator is being built there to-day by the Louisville and Nashville Railroad, and it is almost completed.

The grain market is simply one market. If I sell grain, as I do pretty nearly every day, that grain is taken by the ship that will do it the cheapest. It makes no difference to me whether it goes through New Orleans or Galveston. I am loading vessels in both ports to-day, and also at Newport News and Charleston. There is great competition in grain—so great that half a cent or one eighth of a cent a bushel will frequently determine the route which it will go. That is an important consideration to the corn producer. He is selling his corn to-day at 20 to 21 cents, and I am selling that identical corn in Berlin and France at 41 to 43 cents per bushel. The freight is more than he gets for the raw material three months after it is sent to market.

So I want to repeat again that this is not a local question. The tariff may be, but the improvement of these jetties, so as to give us deep water to the Gulf, is not. The improvement of the Mississippi River to the Gulf affects the corn grower and the oats producer in this country and every country, and the freight to the manufacturer is also affected, so that you gentlemen representing Massachusetts, Texas, or Nebraska, or other States, should be broad enough to take into consideration the interest of the entire country. And we are confident that you will do so, and we will go back and tell our people that you are going to recommend an appropriation for the South Pass and the Southwest Pass as well.

STATEMENT OF CAPT. A. K. MILLER.

Mr. Chairman and Gentlemen of the Committee: I know that your time is precious, and after the able presentation by our worthy chairman of our executive committee yesterday, Mr. Sanders, there is very little left to be said. I think five minutes will be all that I shall require.

I have been familiar with the delta since I was a boy, for I have wrestled with it as a shipmaster. I may speak somewhat feelingly, since I have spent thousands of dollars in endeavoring to get vessels through. We must have deep water to find the great highways of the world. You will pardon a nautical remark if I say that we have been trying to push a 10-inch stream through a 2-inch pipe long enough. Aside from the requirements of commerce, the Mississippi River and its passes are needed by the Government for its ships of war.

This is the only port in the entire Gulf of Mexico that is adapted to the present type of naval ships. We used to think that copper would keep a ship from fouling. I have seen, myself, in the harbor of Havana, a depth of 7 or 8 inches upon a ship of pure copper, so hard in its nature and combined with carbuncles and other barnacles that it was as hard as stone. The iron and steel ship is much more inclined to foul with marine matter than any other, more particularly the steel ship. It is only in a harbor where fresh water prevails that ships can lie and be kept clean, because fresh water destroys the marine matter such as the teredo, or the worm, which so soon destroys our wooden ships. We require more water under the marine ship than we formerly got because there is less buoyancy in proportion to the size. The ship of 300 feet in length, with 35 to 36 feet beam, drawing 24 feet of water, might safely pass over 25-foot depth of water, but a ship of 500 feet in length, with 50 to 60 feet of beam, could not steam through safely. Otherwise she would "smell the bottom," as we express it.

I have some telegrams here received yesterday. One of them states that the *Montezuma* was aground 25 feet from shore in the Grand Bayou Reach, and two other vessels touched bottom and were in a dangerous condition. Those heavy-draft vessels have the tugs still with them.

I am not an engineer, but from my superficial knowledge I fear that 30 feet of water at South Pass, if it can be obtained, will be about all that the banks will stand. I fear that the banks will not stand as much as 30 feet, but it may be that I am wrong. I think it will not stand the erosion with that depth and the volume required to clear the channel. I think that the 26-foot channel is so deep and so crooked that these lengthy ships will find it at times almost impossible to pass without a favorable turn of the tide. If a system of dredging could be applied which would keep the channel at its present depth of water until we could obtain more, we would be in a good condition for the present. It is imperative that we have at least 34 or 35 feet of water, and we require both passes. The passes are subject to collisions, and, considering the size, the tonnage, the length and breadth of vessels, it would be a great disaster if one of these passes should become blocked, and I therefore think that it is important that we should have both passes. I think that the increasing demands of commerce require it. When Captain Eads completed his work the world rejoiced, because it would meet the requirements of the largest ships, and the rates of freight were reduced, as was ably explained by Mr. Sanders on yesterday. It was reduced not only on the shipping, but the railroads have increased in number. Since I first came to New Orleans, in 1871, at least six different lines of railroad have been added to the trade, with terminal facilities. They have spent millions of dollars to build those railroads.

We have often heard the remark, Who are we benefiting in getting deep water—the foreign shipowner? I say, no; it is our own countrymen who will be the sufferers if we do not make these expenditures. The foreign shipowner has got the ports of the world to which to send his ships. It is our own people who will be the sufferers, and, gentlemen, I can not but believe that we will not knock in vain at the door of Congress, but that this mighty river is going to be thrown open to trade and commerce. I am satisfied to leave this case in your hands. Failure to open the mouths of the Mississippi to the deep-draft ships will be an immense commercial disaster, and, furthermore, I think, a national calamity.

Mr. MCCULLOCH. Following up your idea to make the Lower Mississippi a fresh-water harbor for war vessels, will you give the committee the depth of water from the Head of the Passes to New Orleans?

Captain MILLER. I should think that it would not be an exaggeration to say it is an average of 100 feet. There is 170 at some points opposite our city.

Mr. MCCULLOCH. What is the length and width?

Captain MILLER. It is about three-fourths of a mile wide.

The CHAIRMAN. Ships drawing 40 feet can go through the entire distance?

Captain MILLER. Yes, sir.

Mr. MCCULLOCH. It would take in two or three navies like ours?

Captain MILLER. There would be ample room to hold quite a fleet. Formerly, when they were navigable, the ships of the United States were able to go in there when waiting to get to the city.

SUPPLEMENTAL STATEMENT OF CAPT. A. K. MILLER.

Capt. A. K. Miller was sworn and asked to give his testimony. As a seaman and navigator, and knowing the passes for forty-nine years, he said, as commander of ships sailing in and out of Southwest Pass and Pass a Loutre, as steamship agent for twenty-seven years in New Orleans, I am well aware of the importance and necessity of everything that has been asked for by our Representatives.

I have never heard of any master or agent loading a ship by the head except in former days when the trade was conducted by sailing ships principally; it used to be the custom to anchor outside of the passes and trim ship by the head for inward towage, that in case of grounding the ship would lie with the current; but as soon as the introduction of steam tonnage to the large extent that now prevails steamships are always loaded outward bound by the stern, in order that in case of grounding they would lie in a line with the current and not swing across the channel.

How a ship can be loaded depends entirely upon the size of the ship. A ship 300 feet in length, 35-foot beam, drawing 25 feet, can generally pass through a 26-foot channel, but a ship of 400 to 500 feet in length, 45 to 60 foot beam, requires more water under her bottom in proportion to smaller tonnage, otherwise, in nautical parlance, through the lack of requisite buoyancy "she smells the bottom," and then becomes liable to take a sheer against her helm and ground outside the channel. Ships visiting our port require more water under their bottoms for safe navigation than they would in perfectly smooth water. For instance, on our fresh-water lakes, where no current exists, tonnage can be handled with much less water under their keels than in the passes of the Mississippi River where, a constant swift current following them in a narrow channel, it becomes necessary to have more water under their keels.

When I first went into this business as a steamship agent, ships carrying 5,000 bales of cotton were not frequent. Now they carry 25,000 to 30,000 bales. Present facilities as to depth of water prevents our large tonnage from loading full cargoes of grain on account of the insufficient channel, the present channel to the sea being totally inadequate; there is no room to turn in it.

Steamships are increasing in length and size annually. These larger ships require at least 2 feet under their keels to effect steerage in current through the present only pass.

The greatest depth that ever went through the pass was one I sent out drawing 27 feet 3 inches. That ship was what is termed a sharp-bottom ship, or, in other words, considerable dead rise, and consequently better adapted for passing through when slightly grounding. Many ships visiting our port now are flat bottom and built without keels. This type of ship is much more apt to lose her steerage way than one with keel.

I think that the interests of New Orleans requires both passes. Most ships coming to our port are light, or, in other words, without cargo inward bound. The import trade has fallen off greatly since the war.

Would not there be plenty of import trade, demanded Senator Berry, if there was free trade?

Everybody laughed, and Senator Nelson asked if free silver would not help along.

Captain Miller replied that he was a plain sailor man and not versed in politics.

He was followed on the stand by Capt. T. J. Woodward, who has been in touch with the passes and its improvements since 1867.

STATEMENT OF THOMAS J. WOODWARD.

The subject of deep water at the mouth of the Mississippi River and how it can be obtained.—South Pass no longer adequate to afford safe navigation for the modern built freight ships of to-day.

During my long experience as a seaman and navigator, dating back to 1851, when I made my first voyage to New Orleans, and covering many subsequent visits as first officer and captain on ships, and having had frequent opportunities for inspection of the passes since engaging in business in this city in 1868, my opinion is, in all this time the Southwest Pass has always been considered the only best natural outlet from the Mississippi into the Gulf.

It needs no argument from me, or from any intelligent person familiar with existing conditions at the mouth of the Mississippi River, as to the natural advantages of Southwest Pass; it has a nominal depth, as a continuation of the river, of 40 to 60 feet of water to the crest of the bar and carries out 45 per cent of the outflow of the river. South Pass is an artificial outlet, and can never be other than that, and is 12½ miles long from the head of the pass to the sea, and can never be made adequate to accommodate the needs of commerce. The most convincing argument to prove how unnatural is the channel now used through South Pass is the artificial works at the head of the pass, to deflect sufficient water into it to make it navigable, and the most that can be obtained at different stages of the river is 7 to 10 per cent of the outflow, and the great injury done by the deflection works at the head of South Pass will always cause an impediment to the safe navigation of shipping plying to and from this port.

An outlay of, say, $3,000,000 to $4,000,000 to jetty Southwest Pass would for all time give this port a depth of water sufficient for all the needs of commerce.

[Copy.]

NEW ORLEANS, *February 14, 1898.*

Senator KNUTE NELSON, *Chairman:*

The contract between the United States Government and James B. Eads calls for the following channel depths and widths:

From deep water in the river above the Head of the Passes into and through South Pass, 26 feet of depth, of a navigable width.

Through the jetties, 200 feet wide and 26 feet deep, with a central depth of 30 feet.

Over the bar, at the sea end of the jetties to deep water, 200 feet wide and 26 feet deep, with a central depth of 30 feet.

These channel dimensions were sufficient for the fleets of commerce of 1875, composed of vessels rarely exceeding 300 feet in length and 25 feet in draft.

At the present day many ships are built 600 feet long, with a draft of 30 feet, and it is certain that these dimensions will be materially exceeded in the near future.

We assume that it is the intention of the Government to open the mouth of the Mississippi River to every ship in the world that seeks it on a peaceful errand.

We submit that the minimum channel dimensions now necessary to afford this facility to commerce are as follows:

From deep water in the river into the selected pass, a depth of 32 feet, 500 feet wide, within which width an intermediate depth greater than 32 feet would be developed. These dimensions should be carried through the pass and jetties to a point where the swell of the sea is felt, and from this point, the depth of 32 feet, 500 feet wide, should be gradually increased to 35 feet, with the same width, at and over the bar at the sea end of the jetties, with such greater intermediate depths as would be developed. These dimensions should be secured at all stages of the tide and river.

We are of opinion that it would not be practicable, and, if practicable, would not be economical, to enlarge the South Pass and jetty channel sufficiently to obtain these dimensions. The difficulties would be both in securing the enlargement of the waterway and in preserving the integrity of its banks.

We submit with this communication a diagram showing the relative sizes of the channel as now required by law, through South Pass, and of such a channel as is required by the commerce of the present day.

It will be observed that the cross-sectional enlargement called for requires the removal of 557 cubic yards per linear foot, or 34,000,000 cubic yards for the entire length of 12 miles of South Pass. An increased width of channel at the head of the pass and between the jetties would also be necessary, involving the practical reconstruction of these works at both its ends.

The removal of such an enormous mass of material as above indicated from the channel of South Pass, by whatever means accomplished, would of itself plainly involve large expenditures of money and probably require a greater length of time than other parts of the work of improvement; while the necessary reconstruction, or at least remodeling, of the jetties and other works at its head and mouth must form a large share of the cost of any plan for its further improvement.

To sufficiently increase the navigable depth of South Pass without at the same time unduly increasing its width at the expense of its existing natural banks, appears to us a difficult and doubtful undertaking. That it could be so done as to secure an adequate channel for the commerce of the near future without extensive and costly works for the revetment of the banks, so as to prevent their being generally cut back into ground too low to retain the water in the pass, or in some places breached altogether, is, at least, a matter of grave doubt, although of vital importance.

Moreover, it is by no means certain that the work of improvement could be carried on without greatly obstructing the navigation of the pass during its progress.

We are of opinion that such an outlet as the commerce of the Mississippi River and its tributaries now demands can be most surely and economically obtained by the improvement of the Southwest Pass by means of jetties. The requisite width, depth, and proportion of discharge already exists into and through that pass, excepting the 30-foot shoal in the Mississippi River between Cubits Gap at the Head of the Passes. This obstruction is common to all passes, and must be removed whichever one is selected for improvement.

The velocity of flow in a stream varies directly as the square root of the product of its hydraulic radius (or the ratio between the sectional area of the part of the bed it occupies and the frictional or resisting surfaces bounding it) by its slope (or the ratio between its fall and length). As the excess of the hydraulic radius of the Southwest Pass over that of South Pass is greater than the excess of the slope in South Pass over that of Southwest Pass, and as the scouring power increases with the depth and volume it is reasonable to expect that the greater volume flowing through Southwest Pass will, notwithstanding its lesser slope, give it a velocity and scouring power at least as great as that of South Pass. How much greater can only be determined by survey.

We have had neither occasion nor opportunity to make an estimate of the cost of the improvement of Southwest Pass. Undoubtedly it would be considerable but not disproportionate to the object in view.

We believe, however, that many of the predictions as to the first cost and the difficulty of maintenance have been exaggerated. It is of record that the increased rate of advance of the South Pass bar which was anticipated as the result of the building of jetties, both by the opponents and advocates of the project, has not been realized. On the contrary, it has been retarded rather than accelerated. The natural annual extension of the South Pass bar seaward was about 100 feet per year before 1875. General Humphreys, a then chief of engineers, predicted that this rate of advance would be, by the building of jetties, increased to 670 feet per year (Rep. Chief Engineers, 1874, p. 867). General Newton, a member of the "board of engineers on the improvement of the passes as an alternative to or in connection with the Fort St. Philip Canal," which reported adversely to jetties, estimated the annual advance of South Pass bar, after the construction of jetties, at probably 2,240 feet, or at least 1,500 feet (pp. 884–885 of same report).

The Board of Engineers which advised the improvement of the South Pass Bar by jetties, composed of three United States engineers, three civil engineers, and one member of the Coast Survey, were of the opinion that "In an average of many years the rate of progress must be about the same as now, namely, 100 feet per annum," but they assumed that the jetties would have to be extended 1,000 feet in ten years. (Report Chief Engineers, 1875, p. 954.)

It is needless to say that neither the apprehensions of the increased rate of bar growth nor of the necessity of jetty extension have been realized.

We append the average rate of seaward extension of the South Pass Bar since the completion of jetties for every curve of depth from 20 feet to 100 feet, and for the nineteen years from 1876 to 1895. It will be remembered that the growth before the jetties were built was 100 feet per annum.

The curve of 20 feet depth has advanced 33 feet per year; 30 feet depth, 54 feet; 40 feet depth, 48 feet; 50 feet depth, 58 feet; 60 feet depth, 86 feet; 70 feet depth, 68 feet; 80 feet depth, 83 feet; 90 feet depth, 89 feet; 100 feet depth, 86 feet. (Rep. Chief of Engrs.,1896, App. Q, Pl. 1.)

It will be seen from these figures that the average annual advance of the bar has been only about 65 feet, or less than two-thirds the previous rate, and that the curves for 20 feet, 30 feet, and 40 feet depths, with which navigation is immediately concerned, have only advanced, on an average, 45 feet per annum, or less than half the general advance of the bar before the construction of the jetties.

It was observed that the building of the jetties at the Sulina mouth of the Danube Delta retarded instead of accelerating the growth of the bar at its mouth. Sir Charles Hartley, the engineer of the improvement, attributed this to conditions which also prevail to a greater or less extent at the mouth of the South and Southwest passes of the Mississippi. Under these circumstances there is no reasonable foundation for apprehensions of an excessive or extraordinary increase in the annual rate of extension of the Southwest Pass Bar when improved, or of the jetties which should be built across it.

Respectfully submitted.

B. M. HARROD, C. E.,
Member Mississippi River Commission.
HENRY B. RICHARDSON,
Chief State Engineer, Louisiana.

The SUBCOMMITTEE ON THE MISSISSIPPI RIVER OF THE
COMMITTEE ON COMMERCE, UNITED STATES SENATE.

APPENDIX V.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

REPORT OF CAPT. C. S. RICHÉ, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Galveston Harbor, Texas.
2. Ship channel in Galveston Bay, Texas.
3. Channel from Galveston Harbor to Texas City, Texas.
4. Galveston ship channel and Buffalo Bayou, Texas.
5. Operating and care of Morgans Canal, Texas.
6. Trinity River, Texas.
7. Buffalo Bayou, Texas.
8. Channel in West Galveston Bay, Texas.
9. Mouth of Brazos River, Texas.
10. Brazos River between Velasco and Richmond, West Galveston Bay channel, Double Bayou, and mouths of adjacent streams, Texas.
11. Brazos River, Texas.
12. Aransas Pass, Texas.
13. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEYS.

14. Aransas Pass and Harbor, Texas.
15. Mouth of Brazos River near Velasco, Texas.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 17, 1899.

GENERAL: I have the honor to forward herewith annual reports for the works of river and harbor improvements in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

C. S. RICHÉ,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

V 1.

IMPROVEMENT OF GALVESTON HARBOR, TEXAS.

This work is being carried on under a project formulated by a Board of Engineers January 21, 1886, the report on which may be found in the Annual Report of the Chief of Engineers for 1886, page 1294, et seq.

At the close of the last fiscal year both the north and south jetties had been completed, and dredging by the U. S. dredge *Gen. O. B. Comstock* was in progress. At that time the south jetty had been completed for a distance of 35,603 feet, of which 803 feet was a riprap apron, and the north jetty had been completed for a distance of 25,907 feet, of which 307 feet was a riprap apron. These jetties are built of riprap covered with granite blocks, and are carried to an elevation of 5 feet above mean low tide. The general method of constructing the jetties is described on page 1530, Annual Report of the Chief of Engineers for 1892, and page 1392, Annual Report of the Chief of Engineers for 1894. The abstracts of proposals, giving prices paid for the different parts of the work, will be found on pages 1878 and 1879, Annual Report of the Chief of Engineers for 1891.

During the present fiscal year the U. S. dredge *Comstock* and survey tug *Anna* were thoroughly overhauled and repaired. The *Comstock* kept at work dredging along the line of the channel. The *Anna* was kept at work building and repairing survey beacons, making surveys, and removing submarine mines at the close of the war with Spain.

SOUTH JETTY.

The construction of this jetty was considered complete on February 14, 1897, when work was suspended, the jetty having been completed according to the original designs of this office. The total length of this jetty is 35,603 feet, of which 803 feet is a riprap apron.

NORTH JETTY.

The construction of this jetty was considered complete on January 29, 1898, when work was suspended, the jetty having been completed according to the original designs of this office. The total length of this jetty is 25,907 feet, of which 307 feet is a riprap apron.

DREDGING.

During the year the U. S. dredge *Gen. O. B. Comstock* worked nine and one-third months with a single crew, and two and two-thirds months laid up for extraordinary repairs and making change in pumping machinery to enable her to be used as a stationary dredge as well as a seagoing dredge. A description of the dredge *Comstock* will be found on pages 1530–1531, Annual Report of the Chief of Engineers for 1896.

Dredging has been principally confined to the channel between the jetties, which was kept straight and of suitable width. No special effort was made to deepen the channel at the expense of its width and straightness, as the existing depth is ample for all present demands of commerce.

The total amount of material removed during the year was 500,702 cubic yards, of which 157,587 cubic yards was sand taken from the outer bar channel, 76,236 cubic yards was material composed of mud, sand, and fine shell from the channel inside of outer bar, and 266,879 cubic yards mixed material, or silt, taken from the channel inside of outer bar.

A detailed account of the work done will be found in the report of Mr. E. M. Hartrick, assistant engineer, forwarded herewith, and to which attention is invited.

TIDAL OBSERVATIONS.

Tidal observations were practically suspended during the year on account of the U. S. tug *Anna* being engaged on torpedo service and laid up for repairs.

STORMS.

The only storms of any consequence occurred during the months of April, May, and June, 1899, and carried away nearly all that remained of the construction trestle and track and caused more or less settlement of the jetties.

SURVEYS.

The annual survey was commenced in May and continued through June, 1899, a map of which is forwarded herewith. This map also has on it the contours of survey of 1897, thus showing the changes that have occurred since last survey covering this area. The report of Mr. E. M. Hartrick, assistant engineer, gives detailed description of the changes that have occurred in the various contours. The gain in depth on the outer bar during the year was one-half of a foot.

Amount expended on this project to June 30, 1898	$8,251,166.47
Amount expended during the fiscal year	77,099.27
Total amount expended to June 30, 1899	8,328,265.74

Money statement.

July 1, 1898, balance unexpended	$227,133.53
Amount appropriated by river and harbor act approved March 3, 1899	50,000.00
	277,133.53
June 30, 1899, amount expended during fiscal year	77,099 27
July 1, 1899, balance unexpended	200,034.26
July 1, 1899, outstanding liabilities	3,472.76
July 1, 1899, balance available	196,561.50
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	50,000.00

Abstract of appropriations made by Congress for improving harbor at Galveston, Tex.

By act of—		By act of—	
July 11, 1870	$25,000	September 19, 1890	$500,000
March 3, 1871	20,000	March 3, 1891	600,000
June 10, 1872	31,000	August 5, 1892	450,000
June 23, 1874	60,000	March 3, 1893	1,000,000
March 3, 1875	150,000	August 18, 1894	600,000
August 14, 1876	142,000	January 25, 1895	200,000
June 7, 1878	75,000	March 2, 1895	1,160,000
June 18, 1878	50,000	February 26, 1896	300,000
March 3, 1879	100,000	June 3, 1896	50,000
June 14, 1880	175,000	June 11, 1896	840,000
March 3, 1881	250,000	June 4, 1897	500,000
March 4, 1882	100,000	March 3, 1899	50,000
August 2, 1882	300,000		
August 5, 1886	300,000	Total	8,528,000
August 11, 1888	500,000		

In addition to the above appropriations by Congress, there has been collected from steamship *Maritime* $300, making a total of $8,528,300.

COMMERCIAL STATISTICS OF GALVESTON HARBOR, TEXAS, FOR FISCAL YEAR ENDING JUNE 30, 1899.

Tonnage of vessels and revenue collected.

	Steam vessels.	Sailing vessels.	Total.	Total tonnage.
Entered	610	87	697	1,153,999
Cleared	615	81	696	1,158,944
Total	1,225	168	1,393	2,312,943

Duties on imports collected	$154,870.90
All moneys collected at custom-house	208,117.44

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton (2,333,715 bales)	624,268	$70,011,450
Cotton products	289,295	7,223,943
Ore	695	39,572
Wool	4,807	1,251,200
Grain	524,579	11,234,677
Sugar	10,162	699,671
Coal	176,400	1,406,800
General merchandise	469,336	17,341,435
Total	2,099,572	109,208,748

Decrease of freight compared with last year, 830,492 tons.

NOTE.—There was no coastwise trade during the months of the Spanish-American war.

Comparative statements for fiscal years 1897 to 1899.

Articles.	1897.	1898.	1899.
Cotton tons	378,336	413,553	624,268
Cotton products do	162,790	217,037	289,295
Ore do	12,478	8,370	695
Wool do	5,423	6,406	4,807
Grain do	272,340	859,097	524,579
Sugar do	1,133	7	10,162
Coal do	142,092	169,002	176,400
General merchandise do	235,216	1,761,592	469,336
Total tons	1,209,822	2,930,064	2,099,572
Total value	$68,261,553	$94,596,293	$109,208,748

REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 11, 1899.

CAPTAIN: I have the honor to submit the following report of operations for improving Gaveston Harbor, Texas, during the fiscal year ending June 30, 1899.

SOUTH JETTY.

No work was done on South Jetty during the year, as it is considered complete for the present. The railway track over the shore branch to Station 160 has been kept in repair by the fortification force, which also removed and utilized old ties and rails between Stations 160 and 210. From this station gulfward nearly all of the old construction trestle and track has been carried away by storms and high water.

Condition.—The condition of the jetty remains about the same, except that a greater consolidation or settlement appears to have occurred between Stations 270 and 307, between which stations it is in many places awash at ordinary tide. Levels for profile and water cross sections will be taken for comparison as soon as the fortification force can be spared from their particular work.

NORTH JETTY.

No work was done on the North Jetty during the year, as it is considered complete for the present.

Condition.—The condition of the jetty remains about the same, except that subsidence and consolidation continue. The profile run by levels shows that the crest has settled in the last two years from 0.25 foot at Station 130, increasing irregularly to 0.75 foot at Station 240, with a total average subsidence to date of one-third to 1¾ feet. (See table herewith.)

Water cross sections, besides showing a general consolidation of the submerged enrockment, show that a bank has formed against the jetty, making it water-tight on the north side to within 2 feet of mean low tide as far out as Station 40. This bank then decreases in height gradually to 4 feet below mean low tide at Station 70 and to 14 feet at Station 180. A slight scour then occurs, but, in general, the water alongside to the outer end is about the same as at time of construction, except at the extreme outer end, where it has scoured into holes of about 30 feet in depth. The bank is composed of soft mud or silt to about Station 40, then of sand gulfward.

On the inner or south side of the jetty the bank against the jetty is of a similar character as on the north side, but not so high. From Station 150 a decided deepening or scour begins, extending along the jetty for about 7,000 feet to Station 220. This is evidently caused by the 24-foot curve inside and between the jetties impinging against the 18-foot curve and forcing it against the jetty; but as the 24-foot curve does not come in actual contact with the jetty there seems at present no danger of undermining.

The general method of inspection and construction is explained in previous Reports of the Chief of Engineers, where a full description of the plant and methods used can be found, as follows:

Appendix U, 1892, page 1529: Commencement of O'Connor, Laing & Smoot's contract. Construction of South Jetty over the old mattress work.

Appendix U, 1893, page 1865: Starting work on North Jetty and transfer of riprap between Fort Point and Bolivar.

Appendix U, 1894, page 1391: Barge line transporting granite between Clinton and jetty.

Appendix T, 1895, page 1801: Dredging on the outer bar.

Appendix S, 1896, pages 1529–1536: Description and operation of U. S. dredge *Comstock*. Plant of contractors used in construction of jetties. Scour on the outer bar, with map showing area of scour and fill, and table of approximate cubic yards removed. Table of subsidence of jetties and recommencement of work on South Jetty.

Appendix T, 1897, pages 1798–1803: Tables showing average cost per linear foot between stations, and subsidence of jetties.

Appendix V, 1898, pages 1491–1497: Completion of North Jetty and dredging data.

Table showing subsidence of North Jetty.

Stations.	First levels taken after construction.		Elevations.		Subsidence.	
	Date.	Elevation.	May, 1897.	April, 1899.	Last two years.	Total to date.
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
0 to 10	July, 1893	6.42	6.10			0.32
10 to 20	August, 1893	5.60	5.17			.43
20 to 30	September, 1893	4.92	4.47			.45
30 to 40	October, 1893	5.32	4.67			.65
40 to 50	November, 1893	5.43	4.56			.87
50 to 60	December, 1893	5.34	4.75			.59
60 to 70	.....do	5.56	5.06			.50
70 to 80	February, 1894	5.68	5.16			.52
80 to 90	May, 1894	5.91	5.31			.60
90 to 100	June, 1894	5.60	5.48			.12
100 to 110	.....do	5.41	5.			.41
110 to 120	February, 1895	5.21	5.			.21
120 to 130	.....do	4.98	4.80			.18
130 to 140	April, 1895	5.10	4.56	4.34	0.22	.76
140 to 150	.....do	4.90	4.42	4.02	.40	.88
150 to 160	.....do	5.20	4.24	3.88	.36	1.32
160 to 170	May, 1895	5.34	4.53	4.03	.50	1.31
170 to 180	.....do	5.	4.66	3.96	.70	1.04
180 to 190	June, 1895	5.44	4.61	3.95	.66	1.49
190 to 200	November, 1895	5.40	4.53	3.85	.68	1.55
200 to 210	December, 1895	5.26	3.68	3.01	.67	2.25
210 to 220	.....do	4.87	3.65	3.10	.55	1.77
220 to 230	March to June, 1896	5.32	4.20	3.50	.70	1.82
230 to 240	June to October, 1896	4.92	3.75	3.14	.61	1.78
240 to 250	October, 1896, to June, 1897	5.12				

Elevations are in feet, and show the height above mean low tide.
From stations 0 to 130 there was practically no subsidence from 1897 to 1899.

DREDGING.

At the beginning of the fiscal year the *Comstock* was on the ways, laid up for extraordinary repairs which were not finished, as she had to be launched on account of the Navy Department requesting the use of the marine ways for one of its boats.

On August 30, 1898, dredging was recommenced and continued with a single crew to May 28, 1899, when she was again laid up for the annual overhauling and finishing up of repairs left undone. Her capacity and efficiency have been greatly increased by providing arrangements to use her as a stationary dredge to pump material through a line of pipe and fill up the site of the rapid-fire batteries at Fort Point Reservation. The dredge can now be utilized, if protected sufficiently from boisterous weather and heavy seas, in excavating channels and delivering materials on the banks or over a jetty, breakwater, or bulkhead. This is in addition to her former use as a sea-going dredge.

The total amount removed during the year was 500,702 cubic yards, of which 157,587 cubic yards was sand from the outer bar channel; 76,236 cubic yards of material composed of mud, sand, and fine shell, with 266,879 cubic yards of similar material or silt from the channel inside of the outer bar.

The average cost per cubic yard dredged was 6.19 cents for operating expenses, 0.58 cent for additions to plant, and 2.13 cents for extraordinary repairs, making the total average cost per cubic yard 8.90 cents.

Efficiency has increased since the extraordinary repairs 11¼ per cent while working and delivering sand into hopper, and 21 per cent while working in silt, an increase per minute of 0.61 cubic yard and 1.55 cubic yards, respectively.

Details of work done, distribution of time, and cost of dredging are herewith forwarded in tabulated form.

Résumé of work done by U. S. dredge Gen. C. B. Comstock during the fiscal year ending June 30, 1899.

	Hours.	Minutes.
Effective working time	1,881	35
Delays for bad weather	659	11
Delays for repairs	868	41
Delays for other causes	319	8
Idle on account of Sundays and holidays	696	....
Total time made	4,424	35

Distribution of working time.

	Hours.	Minutes.	Per cent.
Anchorage to cut	127	10	6.75
Pumping	1,294	34	69
Cut to dump	143	26	7.75
Dumping	76	40	4
Dump to cut	115	11	6
Dump to anchorage	119	25	6.25
Time lost turning	5	9	.25
Total	1,881	35	100

Number of loads dredged		899
Average output per hour dredging	cubic yards	386.79
Average amount dredged per minute in sand	do	5.40
Average amount dredged per minute in mud, sand, and fine shell	do	6.30
Average amount dredged, in mixed material,[1] per minute	do	7.32

Since the extraordinary repairs to hull and machinery the increased efficiency has been as follows:

	Cubic yards.
Output, per hour	60.90
Average amount dredged in sand, per minute	.61
Average amount dredged in mixed material, per minute	1.55

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[1] Mixed material is composed of silt, or fine mud and shell, with occasional lumps of clay.

Cost of dredging.

	Total amount expended.	Cost per cubic yard.
Wages	$16,984.64	$0.0339
Subsistence	3,868.33	.0077
Fuel	5,592.83	.0111
Oil, waste, packing, etc	1,456.98	.0029
Miscellaneous supplies	1,107.71	.0022
Ordinary maintenance	1,539.56	.0030
Contingent expenses	579.81	.0011
Operating cost	31,129.86	.0619
Addition to plant	2,916.00	.0058
Extraordinary repairs	10,666.22	.0218
Total	44,712.08	.0890

SURVEYS.

Surveys of the outer bar and hydrographic work in general were suspended during the first half of the fiscal year on account of the survey boat *Anna* being used on torpedo defense of the harbor. As soon as the *Anna* had been released from torpedo service she was put to work on the erection of iron survey beacons located near the ends of North and South Jetties. These beacons are used in the surveys of the harbor and mark the positions of the jetties for mariners.

The annual survey was commenced in May and continued through June, 1899. The same area was surveyed as in 1897, i. e., Galveston Channel, from Fortieth street; Bolivar Channel, from Bolivar Transfer Wharf, and Pelican Spit to 30 feet of water in the Gulf of Mexico. The comparison is made with the survey of 1897 because there has been no survey covering the above area since that date. The survey of 1898 was limited to the outer bar and channel, owing to work on National Defense (war) taking up the time of the survey boat and the field and office force.

By comparing the curves of depth with those of 1897 it is found that the outer 30-foot curve has advanced on the axis of the channel about 800 feet; the inner 30-foot curve has advanced 2,000 feet, thereby lessening the distance between the inner and outer 30-foot curves 1,400 feet. There are also 7,400 feet of elongated 30-foot holes in this channel, leaving about 10,900 feet, as against 19,700 feet, length of channel to be excavated about 4 feet to procure 30 feet of water. The 24-foot curve outside has advanced 800 feet on the north side of channel and receded 2,900 feet on the south side, but leaving a middle ground of 2,400 feet at Gulf end, with 21½ feet least depth. Between this middle ground and the 24-foot curve there is a southeast channel developing. It is on the line of least resistance, having 1,300 feet of 30-foot depths and over on its axis between 26 feet in the present channel and 30 feet in the Gulf. By making this the main channel the dredge would have less distance to cover on the outer-bar channel, be better protected from heavy seas, and could work to better advantage on the ebb and flood, as the currents strike this channel more obliquely.

The 24-foot channel inside and between the jetties, west of range light on North Jetty, has widened considerably, and now has a least width of 2,200 feet. The north 24-foot curve of this channel runs parallel to North Jetty for 10,000 feet, at a distance of 800 to 900 feet from the axis of the jetty. It has a decided tendency to break through the outer bar and form a new east channel, on a line parallel and at the same distance from North Jetty as above. It is greatly encouraged in this direction by the 30-foot curve in the Gulf having receded toward the end of North Jetty 2,200 feet in the last two years, while it has advanced in the same time from 400 to 800 feet on the south half of the entrance.

The present bar channel from the inner gas buoy gulfward has increased in width between the 24-foot curves from 400 feet in 1897 to 700 feet in 1899, and its center depth has increased one-half foot. There is now a good 26-foot navigable channel over 300 feet wide.

There still remains on the outer bar, north of the channel, a small area bounded by the 18-foot curves having a least depth of 16½ feet on its crest.

Galveston inner bar has increased from 25 to 26 feet in depth, but unless wharves are built out to the harbor lines on both sides and abreast of the inner bar, so as to act as parallel jetties, a dredge will have to be used on this bar to procure 30 feet of water. A dredge will also have to be used on the middle ground, between Bolivar Roads and Galveston Channel, where the present depth is only 28 feet. Bolivar Gorge, where Bolivar Light bears NNE., has moved south about 200 feet, and Bird

Island Shoal has advanced southerly to about the same extent. The channel between Bird Island Shoal and Bolivar Peninsula has shoaled slightly; otherwise this particular area, including the gorge, remains about the same.

Pelican Spit remains about the same, but the flats immediately south have shoaled so that in some places they now form part of the Spit, extending to Red Beacon in Galveston Channel.

Galveston Channel remains about the same, except along the wharves, where dredging has increased the depth.

The shore line on Bolivar Peninsula remains about the same on the southwest side of North Jetty, but has moved from 100 to 600 feet gulfward on the northeast side of North Jetty.

The shore line at the eastern end of Galveston Island has advanced gulfward 700 feet at South Jetty, diminishing to nothing at First street, at which point it begins to encroach on the city as far southwest as Twenty-seventh street.

AUTOMATIC TIDE GAUGES.

Tidal observations were suspended during the year, first on account of National Defense (war); then the *Anna* was laid up for extraordinary repairs from the effect of the torpedo service; then other work prevented the starting up of gauges, except for a short time.

Table showing increase in depth on Galveston Bar.

Date.	Depth.		Remarks.
	Inner bar.	Outer bar.	
	Feet.	*Feet.*	
	9½	12	Original depth.
1894	23½	12¾	Improvements at various times of the inner bar gave 21 feet in 1884. No further work has been done on this bar except dredging for a few days in 1898. The wharves and jetty adjacent to this bar are evidently the cause of its maintaining and increasing the depth of 1884.
1895	23½	17¾	
1896	24	22	
1897	25	24	
1898	26	25½	
1899	26	26	

RESURVEY OF GALVESTON BAY.

At the beginning of the fiscal year the base line had been measured west of Texas City on the main land and a new triangulation plan devised for Galveston Harbor and entrance, upper and lower bays, West Bay and Trinity Bay, and part of East Bay, all of Galveston Bay. (Annual Report of the Chief of Engineers for 1898, pp. 1497-1504.) The continuation of the survey was delayed the first half of the year by work on National Defense (war), and it was still further delayed for the annual survey of Galveston Harbor and entrance, so that both could be carried on at the same time and at less expense.

In May and June 1899, when the *Anna* and crew could be spared from the annual survey, the tripods and scaffolds at north and south base were erected and beacons for hydrographic work set up in lower bay. It is expected from this time forward to vigorously push the resurvey of the bay and connect with the survey of Galveston Ship Channel and Buffalo Bayou, Texas, in the near future.

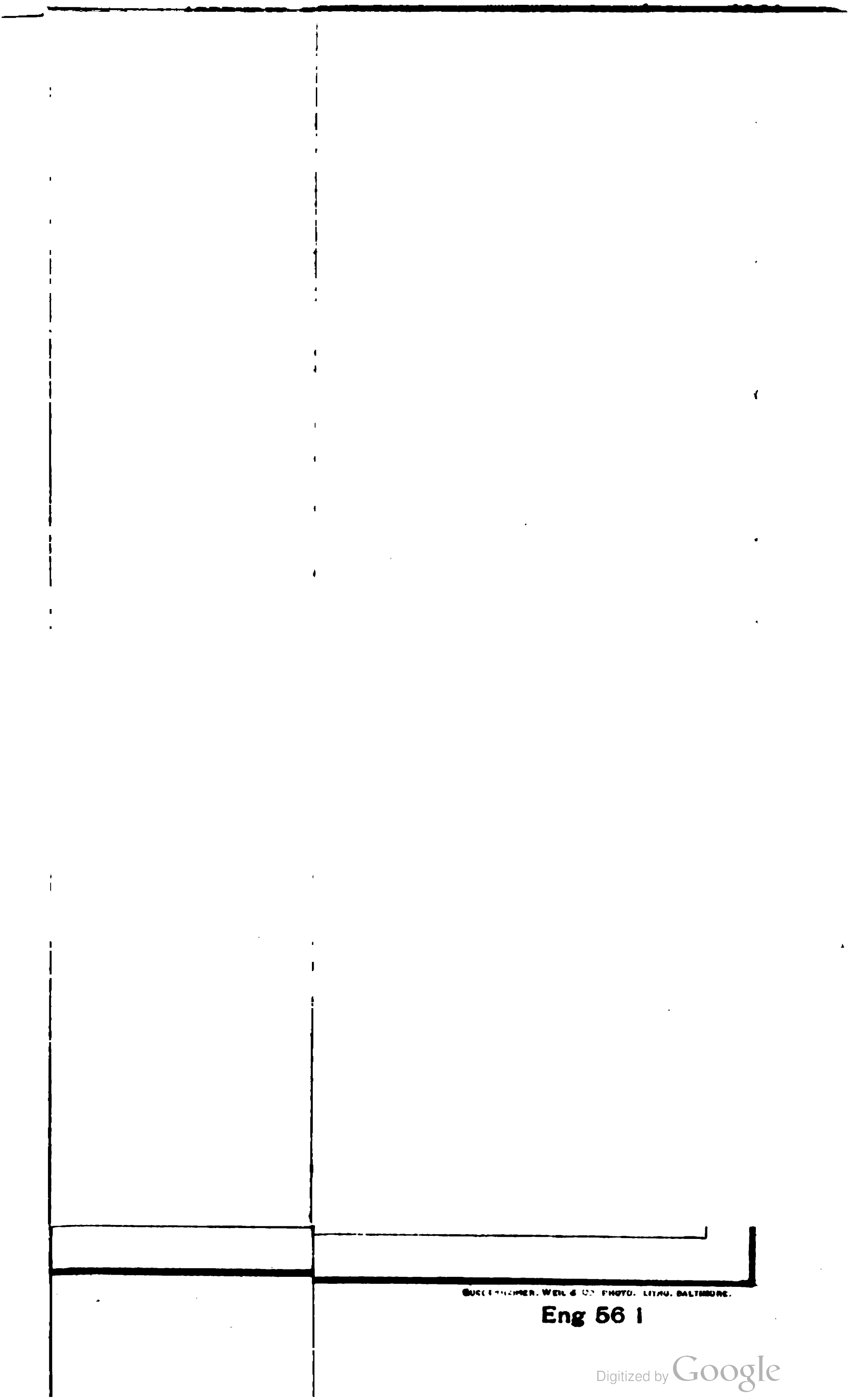
STORMS.

There were no extraordinary storms during the year, but a succession of strong gales during April, May, and June, 1899, carried away nearly all that remained of the construction trestle and track and caused more or less settlement of the jetties.

Very respectfully, your obedient servant,

E. M. HARTRICK, *Assistant Engineer.*

Capt. C. S. RICHÉ,
Corps of Engineers, U. S. A.



GUGGENHEIMER, WEIL & CO. PHOTO. LITHO. BALTIMORE.

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V 2.

IMPROVEMENT OF SHIP CHANNEL IN GALVESTON BAY, TEXAS.

The dredging of a channel through Galveston Bay was undertaken with a view of affording the commerce of the streams emptying into its northern portion an outlet to Galveston and the Gulf of Mexico.

No work was done during the present fiscal year, nor has any been done since operations were suspended September 26, 1895, as the depth of water in the channel was greater than that found in Buffalo Bayou, immediately at and below Houston, and was sufficient for the draft of vessels navigating the bay; also as Congress had indicated a possible intention of again amending the project, so as to provide a channel having a depth of 25 feet instead of 12 feet.

A survey of the bay along the line of the ship channel was made in March, 1897, in compliance with an act approved February 1, 1897, public, No. 38, providing for an examination and survey of a water route from the mouth of the jetties at the city of Galveston, Tex., through the ship channel and up Buffalo Bayou to the city of Houston, Tex.

Upon plotting the survey it was observed that a shoaling of from 2 to 3 feet had occurred at Morgans Cut, and that the channel in the lower bay had practically been obliterated.

In future work on this improvement will be conducted in connection with appropriation for improving Galveston Ship Channel and Buffalo Bayou. (See report herewith on improving Galveston Ship Channel and Buffalo Bayou.)

Total amount expended on this improvement to June 30, 1899, $800,328.16.

Money statement.

July 1, 1898, balance unexpended	$48, 688. 69
July 1, 1899, balance unexpended	48, 688. 69

Abstract of appropriations made by Congress for improving ship channel in Galveston Bay, Texas.

By act of—	
June 10, 1872	$10, 000. 00
June 23, 1874	10, 000. 00
March 3, 1875	35, 200. 00
August 14, 1876	72, 000. 00
June 18, 1878	75, 000. 00
March 3, 1879	80, 000. 00
June 14, 1880	50, 000. 00
March 3, 1881	50, 000. 00
August 2, 1882	$94, 500. 00
August 11, 1888	100, 000. 00
September 19, 1890	132, 316. 85
July 13, 1892	40, 000. 00
August 18, 1894	50, 000. 00
June 3, 1896	50, 000. 00
Total	849, 016. 85

COMMERCIAL STATISTICS OF SHIP CHANNEL IN GALVESTON BAY, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

It is not practicable to give the statistics of the commerce of the ship channel. Almost the entire floating commerce of Buffalo Bayou, Trinity River, and Cedar Bayou is carried through this channel, the commercial statistics being given in the reports on these works. The number of vessels passing through Morgans Canal during the year was 1,122, of which 417 were north bound and 705 were south bound.

V 3.

IMPROVEMENT OF CHANNEL FROM GALVESTON HARBOR TO TEXAS CITY, TEXAS.

This channel is designed to afford a channel 100 feet wide at bottom and 25 feet deep north of Pelican Island from Galveston Harbor to Texas City, Tex.

No work was done during the present fiscal year.

Bids for dredging the proposed channel were advertised for May 15, 1899, and opened June 15, 1899, one bid being received. Up to the close of the fiscal year no contract had been awarded.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$250,000.00
July 1, 1899, balance unexpended	250,000.00

Abstract of appropriations made by Congress for deepening the channel from Galveston Harbor to Texas City, Tex.

By act of March 3, 1899	$250,000

Abstract of bids for deepening the channel from Galveston Harbor to Texas City, Tex., received in response to advertisement of May 15, 1899, by Capt. C. S. Riché, Corps of Engineers, at Galveston, Tex., and opened July 15, 1899.

Name and address of bidder.	Address of bidder.	Amount bid.
Rittenhouse Moore Dredging Co	Mobile, Ala	$230,000

Up to close of fiscal year contract had not been awarded.

REPORT ON DEEPENING THE CHANNEL FROM GALVESTON HARBOR TO TEXAS CITY, TEX.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., January 18, 1899.

GENERAL: In accordance with your letter of the 12th instant and subsequent telegrams, I have the honor to report that on yesterday I telegraphed you as follows:

> Texas City channel, one hundred feet bottom width; thirty-two hundred thousand yards, at fifteen cents, present contract rate, with contingencies, five hundred thousand dollars. If Government had dredge like those on Mississippi, three hundred fifty thousand dollars, including cost of dredge.

To improve the channel connecting Texas City on the west shore of Galveston Bay with Galveston Harbor by deepening the same to 25 feet will require 3,200,000 cubic yards of excavation, bank measure, provided the slopes are made 1 on 4, which is the slope recommended for the sides of the ship channel to Houston by the Board of Engineers on that project about a year ago. If this work be done by contract, there is not much prospect of our getting extensive competition. Contracting plants in this vicinity are few and antiquated, and are far inferior for work of this character to those on the Mississippi River.

The nature of the material to be excavated is sand, with, in places, considerable clay, hard enough to require mechanical cutters, too hard, in all probability, for a jet to stir it up sufficiently to feed the suctions of the dredge pumps.

As prices are in this district. and in view of the difficulty of securing competition, I do not feel that I can safely estimate this work at less than 15 cents per cubic yard, bank measure, which, with $20,000 for contingencies, etc., would make the total estimated cost $500,000, if done by contract.

On the other hand, if the Government owned a modern suction dredge, similar to those in use on the Mississippi River and to those recommended by the Board of Engineers for the Houston ship channel, I believe the work could easily be done for the figures given in Mr. Hartrick's tabulated statement herewith. Taking the side slopes 1 on 4, this would make the cost of dredging $202,546.27. Adding to this a reasonable allowance for contingencies, as well as the cost of such a dredge, would make the estimate for the work, if done by the Government with its own dredge, $350,000.

There is such a difference between these two estimates as to make it seem likely that if the work were to be done by contract some firm would build a suitable dredge and do the work for about the same amount as last stated, having the dredge on hand for further work of similar character; but there is no way by which I can feel assured that this would be done. Hence I make the larger estimate in case it should be desired to do the work by contract.

Attention is invited to the accompanying report by Assistant Engineer E. M. Hartrick.

Very respectfully, your obedient servant,

O. S. RICHÉ,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF ASSISTANT ENGINEER E. M. HARTRICK.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., January 18, 1899.

CAPTAIN: In compliance with your instructions to make an estimate of cost for improvement of the channel connecting Texas City with 25 feet of water in Galveston Harbor, I have the honor to report:

No survey was necessary to determine the condition of the old cut, as it has been practically obliterated.

In taking out quantities the condition of the old cut has been assumed as having a depth of 8 feet below mean low tide, with an average width of 50 feet.

Accompanying is a sketch[1] showing the direction of cut and proposed dumping ground. The channel length is divided into three divisions, as the conditions vary more or less in each division.

Division A is 11,200 feet long from Texas City to 6-foot curve in Galveston Bay; also known as Texas City cut.

Division B is 6,750 feet long from Texas City cut across Galveston Bay to the 6-foot curve off Pelican Island; also known as Galveston Bay cut.

Division C is 13,470 feet long from Galveston Bay cut to head of Bolivar Channel and 25 feet of water.

The channel cross section from which the quantities have been calculated has a bottom width of 100 feet, depth of 25 feet, and slope 1 on 2 and 1 on 4.

It has been assumed that all material will have only to be removed from 300 to 500 feet, except in Division B, where the maximum haul will be 4,000 feet.

The contract price for dredging 12 feet deep, scow measurement, on ship channel and removing spoil over 2 miles was from 9½ to 14 cents per cubic yard. For 25 feet deep a contractor most likely could be found to do it for 15 cents if given the whole work. Mr. Myers stated that he could get it done for 13 cents per cubic yard.

Inclosed will be found sketch[1] showing proposed channel and tabulated statement of cost, etc.

Very respectfully, your obedient servant,

E. M. HARTRICK, *Assistant Engineer.*

Capt. C. S. RICHÉ,
Corps of Engineers, U. S. A.

Cost provided a Government dredge is available, similar to that recommended for the Houston Ship Channel.

[Bottom width 100 feet; depth 25 feet.]

Division.	Length.	Cubic yards, slope 1:2.	Per cubic yard.	Cost of dredging.	
				Slope 1:2.	Slope 1:4.
	Feet.				
A	11,200	1,101,867	$0.05	$55,093.35	$70,834.30
B	6,750	585,850	.08	46,868.00	60,258.86
C	13,470	926,244	.06	55,574.64	71,453.11
	31,420	2,613,961	....	157,535.99	202,546.27

Cost if done by contract.

Slope 1:2, 2,613,961 cubic yards, at 15 cents	$392,094.15
Slope 1:4, 3,360,807 cubic yards, at 15 cents	504,121.05

Myers figures 1,800,000 cubic yards at 13 cents (24 feet deep), $234,000.

V 4.

IMPROVEMENT OF GALVESTON SHIP CHANNEL AND BUFFALO BAYOU, TEXAS.

The object of this improvement is to provide the city of Houston with a waterway to Galveston and the Gulf of Mexico, having a channel depth of 25 feet. (Annual Report Chief of Engineers for 1898, page 1516 et seq.)

This work now embraces two separate improvements—i. e., improving ship channel in Galveston Bay, Texas (Annual Report Chief of Engineers for 1892, page 1536 et seq.), and improving Buffalo Bayou, Texas (Annual Report Chief of Engineers for 1891, page 1344 et seq.).

The funds available at the end of the fiscal year for improving ship channel in Galveston Bay and improving Buffalo Bayou are to be used in dredging in the locality for which the funds available were appropriated, and in constructing a dredge in connection with the appropriation for improving Galveston Ship Channel and Buffalo Bayou, Texas.

Nothing but preliminary work was done during the present fiscal year.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$300,000.00
July 1, 1899, balance unexpended	300,000.00
Amount (estimated) required for completion of existing project	3,700,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

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[1] Not printed.

Abstract of appropriations made by Congress for improving Galveston Ship Channel and Buffalo Bayou, Texas.

By act of March 3, 1899	$300,000

COMMERCIAL STATISTICS.

The commercial statistics of this improvement are given in report on improving Buffalo Bayou, Texas, herewith.

V 5.

OPERATING AND CARE OF MORGANS CANAL, TEXAS.

A watchman was stationed at Morgans Point in charge of Morgans Canal. His services were paid from allotment of $360, made by the Department on July 1, 1898, from the permanent indefinite appropriation provided for in section 4, act of July 5, 1884. This amount was expended as follows:

James A. Black, salary, twelve months, at $30	$360

Abstract of allotments made for operating and care of Morgans Canal, Texas, provided for by section 4, act of July 5, 1884.

December 2, 1896	$240
July 16, 1897	360
July 1, 1898	360
Total	960

V 6.

IMPROVEMENT OF TRINITY RIVER, TEXAS.

Work at this locality is confined to the mouth and consists in constructing two jetties at the entrance known as the Middle Pass, the one generally used by vessels, with a view to deepening the water on the bar opposite it to 6 feet.

The west jetty was completed on April 6, 1894, and a channel was dredged across the bar immediately afterwards so as to afford navigation temporary relief.

No work was done during the present fiscal year, nor has there been any since operations were suspended in 1894, the construction of the east jetty having been postponed until sufficient funds were on hand to enable it to be built quickly and economically.

In future, work on the mouth of this stream will be conducted in connection with appropriation for the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams. (See report herewith on improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams.) The $7,000 appropriated by river and harbor act approved March 3, 1899, is to be expended in making reconnaissances, surveys, etc., from the city of Dallas, Tex., to the mouth, and in such snagging operations as may be most urgent. No work was done during the present fiscal year, except to organize a survey party to take the field early in July, 1899.

Amount expended on this improvement to June 30, 1899, $69,444.76.

Money statement.

July 1, 1898, balance unexpended	$7,555.24
Amount appropriated by river and harbor act approved March 3, 1899	7,000.00
July 1, 1899, balance unexpended	14,555.24

Abstract of appropriations made by Congress for improving Trinity River, Texas.

By act of—	
June 18, 1878	$10,000
March 3, 1879	2,500
June 14, 1880	4,000
March 3, 1881	10,000
August 2, 1882	8,000
August 11, 1888	12,500
September 19, 1890	10,000
July 13, 1892	$10,000
August 18, 1894	5,000
June 3, 1896	5,000
March 3, 1899	7,000
Total	84,000

COMMERCIAL STATISTICS OF TRINITY RIVER, TEXAS, FOR FISCAL YEAR ENDING JUNE 30, 1899.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained, but they are probably about the same as for last year, viz:

COMMERCIAL STATISTICS OF TRINITY RIVER, TEXAS, FOR FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using the river, 30 (28 sailing vessels, 1 barge, and 1 steamer); length on deck, 30 to 100 feet; draft, 2.5 to 5 feet; tonnage, 4 to 150 tons; trips made during the year, 829; total tonnage, 10,728.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	79	$7,875.00
Lumber	8,747	26,337.00
Coal	385	1,540.00
Stock	86	708.00
General merchandise	561	20,037.00
Total	9,858	56,497.00

Increase since last year, 3,030 tons.

Comparative statement for fiscal year 1896 to 1898.

Articles.		1896.	1897.	1898.
Cotton	tons	27	92	79
Lumber	do	6,955	5,795	8,747
Coal	do	602	718	385
Stock	do	64	37	86
General merchandise	do	73	156	561
Total tonnage		7,721	6,828	9,858
Total value		$37,846	$50,606	$56,497

V 7.

IMPROVEMENT OF BUFFALO BAYOU, TEXAS.

The object of this work is to provide the city of Houston, Tex., with a waterway to Galveston and the Gulf of Mexico, having a depth of 12 feet.

Work was suspended on November 4, 1895, at which time there was a depth of 10 feet in the channel, which had also been cleared of obstructions.

No work was done during the present fiscal year, because there was ample depth of water in the bayou at the beginning of the cotton season to satisfy the demands of commerce, and as Congress, by act approved February 1, 1897 (Public, No. 38), had indicated a possible intention of providing a channel 25 feet deep instead of 12 feet in the bayou, and also of establishing a harbor at or near Houston 25 feet deep.

The survey called for by above-mentioned act was made in March, 1897. It developed the fact that but little shoaling had occurred except directly at and for a short distance below the city of Houston.

In future, work on this improvement will be conducted in connection with appropriation for improving Galveston Ship Channel and Buffalo Bayou, Texas. (See report herewith on improving Galveston Ship Channel and Buffalo Bayou, Texas.)

Amount expended on this improvement to June 30, 1899, $210,137.64.

Money statement.

July 1, 1898, balance unexpended	$18, 612. 36
July 1, 1899, balance unexpended	18, 612. 36

Abstract of appropriations made by Congress for improving Buffalo Bayou, Texas.

Act of—		Act of—	
March 31, 1881	$25, 000	July 13, 1892	$25, 000
August 2, 1882	50, 000	August 18, 1894	15, 000
July 2, 1884	25, 000	June 3, 1896	20, 000
August 5, 1886	18, 750		
August 11, 1888	25, 000	Total	228, 750
September 19, 1890	25, 000		

COMMERCIAL STATISTICS OF BUFFALO BAYOU, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

Vessels using bayou, 59 (7 steam vessels, 30 sailing vessels, and 22 barges); lengths, 20 to 160 feet; draft, 2.5 to 6.5 feet; tonnage, 2.5 to 350 tons; trips made during the year, 2,882; total tonnage, 318,511.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton (452,531 bales)	134, 388	$13, 575, 930
Cotton products	14, 708	843, 480
Ore	2, 095	240, 000
Wool	50	10, 000
Lumber	15, 169	85, 000
General merchandise	40, 359	250, 000
Total	206, 769	14, 454, 410

Increase since last year, 46,301 tons.

Comparative statement for the fiscal years 1897 to 1899.

Articles.	1897.	1898.	1899.
Cotton .... tons..	82,767	123,506	134,388
Cotton products .... do...	22,823	12,596	14,708
Coal .... do...	1,948	4,758	....
Lumber .... do...	2,569	4,440	15,169
Building material .... do...	10,158	7,028	....
General merchandise .... do...	8,789	8,141	40,359
Ore .... do...	....	....	2,095
Wool .... do...	....	....	50
Total tonnage	129,054	160,468	206,769
Total value	$13,584.293	$16,243,796	$14,454,410

V 8.

IMPROVEMENT OF CHANNEL IN WEST GALVESTON BAY, TEXAS.

This channel is designed to afford inside water connection between the Brazos River and Galveston having a depth of 5 feet. Operations were suspended on October 2, 1895, at which time a channel 100 feet wide and from 3 to 3½ feet deep was available.

No work was done during the present fiscal year because a greater depth of water exists in the bay than is found in the Galveston and Brazos Canal, owned by a private corporation having the right to levy tolls, and through which most vessels plying between Galveston and the Brazos River passed.

In future work on this improvement will be conducted in connection with appropriation for improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams. (See report herewith on improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams.)

Total amount expended on this improvement to June 30, 1899, $19,775.97.

Money statement.

July 1, 1898, balance unexpended	$5,224.03
July 1, 1899, balance unexpended	5,224.03

Abstract of appropriations made by Congress for improving channel in West Galveston Bay, Texas.

By act of—

July 13, 1892	$15,000
August 18, 1894	5,000
June 3, 1896	5,000
Total	25,000

COMMERCIAL STATISTICS OF WEST GALVESTON BAY, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1899.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained, but they are probably about the same as for fiscal year 1898, viz:

COMMERCIAL STATISTICS OF WEST GALVESTON BAY, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using bay, 19 (1 steam and 18 sailing vessels); length, 20 to 100 feet; draft, 2 to 5 feet; tonnage, 3 to 100 tons.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	3,085	$431,900
General merchandise	8,200	394,830
Total	11,285	826,730

Increase since 1897, 185 tons.

Comparative statement for fiscal years 1896 to 1898.

Articles.	1896.	1897.	1898.
Cotton ... tons	1,875	3,000	3,085
General merchandise ... do	4,500	8,100	8,200
Total tonnage	6,375	11,100	11,285
Total value	$442,500	$810,000	$826,730

V 9.

IMPROVEMENT OF MOUTH OF BRAZOS RIVER, TEXAS.

Proposed work at this locality consists in putting the present jetties at the mouth of the river, formerly owned by the Brazos River Channel and Dock Company, in a fair condition for protecting a dredge while working in the channel, also in making a beginning in the construction of spur dikes to narrow the channel between the jetties, and to dredge a channel to a depth of 18 feet at mean low tide and 150 feet wide.

The Brazos River Channel and Dock Company, under date of April 25, 1899, filed with the Secretary of War a transfer to the United States of the jetties and auxiliary works, also a release of all rights and privileges conferred upon said company by its charter or by the act of Congress approved August 9, 1888, to charge or collect tolls for the use and navigation of said river. Above papers were recorded in the county of Brazoria, Texas, on the 11th day of May, 1899.

No work was done during the present fiscal year, no notice having been received as to action on the project submitted.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$85,000.00
July 1, 1899, balance unexpended	85,000.00
Amount (estimated) required for completion of existing project	165,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	165,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations made by Congress for improving mouth of Brazos River, Texas.

By act of March 3, 1899	$85,000

V 10.

IMPROVEMENT OF THE BRAZOS RIVER BETWEEN VELASCO AND RICHMOND, WEST GALVESTON BAY CHANNEL, DOUBLE BAYOU, AND THE MOUTHS OF THE ADJACENT STREAMS.

Heretofore the projects embraced in this improvement have been independent (improving Brazos River, Texas, between Velasco and Richmond, Annual Report Chief of Engineers for 1895, pages 1838 et seq.; improving channel in West Galveston Bay, Annual Report Chief of Engineers for 1892, pages 1556 et seq.; improving Double Bayou, Annual Report Chief of Engineers for 1898, pages 287 et seq.).

The funds available at the end of the fiscal year for improving Brazos River, Texas, channel in West Galveston Bay, and Trinity River, Texas, are to be used in dredging and snagging at those points in connection with the present appropriation. The present appropriation is to be expended in designing, constructing, and operating a combined dredge and snag boat.

The object of the improvement is to obtain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of most of the streams and bayous along the Texas coast.

Nothing but preliminary work was done during the present fiscal year.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$65,000.00
July 1, 1899, balance unexpended	65,000.00
Amount (estimated) required for completion of existing project	(1)
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	150,000.00

Abstract of appropriation made by Congress for the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams.

By act of March 3, 1899	$65,000

V 11.

IMPROVEMENT OF BRAZOS RIVER, TEXAS.

Under the present project the improvement of this stream is confined to the removal of snags and other obstructions from the bed and banks between Velasco and Richmond, a distance of 89 miles.

It is expected that the work, when completed, will put that portion of the river in a good navigable condition at ordinary stages of water, but the improvement will not be permanent unless the obstructions brought down on each rise in the river are removed annually.

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[1] The amount required for completion of project can not be stated until the examination and survey of the various adjacent streams has been completed. Reports on these surveys will be submitted as soon as possible.

No work was done during the fiscal year, owing to the unfavorable stage of water in the river, nor has any of the appropriation been expended.

In future, work on this improvement will be conducted in connection with appropriation for the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams. (See report herewith on the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay Channel, Double Bayou, and the mouths of adjacent streams.)

Amount expended on this improvement to June 30, 1899, $20.

Money statement.

July 1, 1898, balance unexpended	$4,980.00
July 1, 1899, balance unexpended	4,980.00

COMMERCIAL STATISTICS OF BRAZOS RIVER, TEXAS, BETWEEN VELASCO AND RICHMOND, FOR FISCAL YEAR ENDING JUNE 30, 1899.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained, but they are probably about the same as for last year, viz:

COMMERCIAL STATISTICS OF BRAZOS RIVER, TEXAS, BETWEEN VELASCO AND RICHMOND, FOR FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using river, 35 (6 steam and 29 sailing vessels); length, 15 to 100 feet; draft, 2½ to 9 feet; tonnage, 6 to 47 tons.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	3,785	$600,400
Cotton seed	8,000	48,000
Cattle	2,200	66,000
Lumber	500	4,500
General merchandise	950	80,750
Total	15,435	799,650

Increase since 1897, 735 tons.

Comparative statement for fiscal years 1897 and 1898.

Articles.	1897.	1898.
Cotton tons	3,750	3,785
Cotton seed do	7,500	8,000
Cattle do	2,000	2,200
Lumber do	450	500
General merchandise do	1,000	950
Total tonnage	14,700	15,435
Total value	$794,000	$799,650

V 12.

IMPROVEMENT OF ARANSAS PASS, TEXAS.

Work at this locality is to be confined to constructing two parallel jetties, also in removing a portion of the old Government jetty, and in dredging with a view of obtaining a channel 20 feet deep with a bottom width of 300 feet.

Nothing but preliminary work was done during the present fiscal year. The amount expended during the year was $135.70 and was used in paying expenses of an inspection of the present works at that point, and in recording deed of the Aransas Pass Harbor Company.

The Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges heretofore granted to it in Aransas Harbor by Congress, also the jetties constructed in said harbor. Above paper was filed for record in the county of Aransas on May 3, 1899, and in the county of Nueces on May 16, 1899.

No commercial statistics for the fiscal year ending June 30, 1899, could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899..	$60,000.00
June 30, 1899, amount expended during fiscal year	135.70
July 1, 1899, balance unexpended	59,864.30
Amount (estimated) required for completion of existing project	1,680,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901	500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Abstract of appropriations made by Congress for improving Aransas Pass, Texas.

By act of March 3, 1899	$60,000

V 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

On November 9, 1875, the steamship *City of Waco* was burned off the entrance to Galveston Harbor. This wreck has been a menace to navigation, being in the track of vessels entering and leaving Galveston Harbor. The position of the wreck is shown on Coast Survey Chart No. 205, about 1½ miles off the outer end of South Galveston jetty.

On June 13, 1899, permission was granted, and an allotment of $200, made under the provisions of acts of June 14, 1880, and March 3, 1899, to defray the expenses of an examination of the wreck by divers, to ascertain her condition, with a view to removing same.

Owing to unfavorable weather it has been impossible, up to the close of the fiscal year, to have an examination of the wreck made.

V 14.

PLANS AND ESTIMATES FOR THE IMPROVEMENT OF ARANSAS PASS AND HARBOR, TEXAS.

[Printed in House Doc. No. 119, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 30, 1898.

SIR: I have the honor to return herewith Senate resolution of May 19, 1898, and concurrent resolution of Congress adopted by the House of Representatives May 26, 1898, and agreed to by the Senate May 28, 1898, by both of which the Secretary of War is authorized and directed to prepare and submit plans, specifications, and estimates for the improvement of harbor at Aransas Pass, Texas. The Senate resolution calls for more detailed information, but it has been assumed that it was intended that its requirements should be superseded by the more general terms of the concurrent resolution. In response to the reference of these papers to this office, I beg to submit the accompanying copy of report, dated December 17, 1898, with map[1] by a board of engineers which had previously had the improvement of Aransas Pass under consideration, and which was reconvened for the purpose of furnishing the information called for by Congress.

The Board is of the opinion that in order to improve Aransas Pass it will be necessary to both remove the sand bar at the mouth and to extend the shore protection heretofore built on the head of Mustang Island; and that to remove the sand bar and deepen the channel across it to a depth of at least 20 feet and a width of at least 150 feet at the bottom it will be advisable to build two parallel jetties and to have recourse to dredging. It is proposed to locate one of these jetties essentially on the line of the jetty partially constructed by the Aransas Pass Harbor Company, and to remove the outer 1,000 feet of foundation of the Harbor Company's jetty and a portion of the old Government jetty.

The Board states that Aransas Pass Harbor *is worthy of immediate improvement*, but in its opinion the interests of navigation demand that the bottom width of the 20-foot channel between the jetties should be at least 300 feet. The estimated cost of the plan of improvement outlined in the accompanying report is $1,525,000; but the plans and estimates submitted must be regarded as subject to modification should a survey made at the time work is to be done show material changes in the local conditions. I concur in the views of the Board.

In concluding the report attention is invited to the narrow and shallow channel between Aransas Pass and the town of Corpus Christi. The Board believes that this channel should be dredged to a depth of 12 feet at mean low water, with width of 150 feet at bottom, and estimates the cost of the work at about $215,000.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

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[1] Not reprinted. Printed in House Doc. No. 119, Fifty-fifth Congress, third session.

REPORT OF BOARD OF ENGINEERS.

NEW YORK CITY, *December 17, 1898.*

GENERAL: The Board of Engineers constituted by paragraph 6, Special Orders, No. 145, War Department, Adjutant-General's Office, Washington, June 23, 1897, was convened at New York City by Special Orders, No. 24, headquarters Corps of Engineers, U. S. A., Washington, D. C., October 1, 1898, as follows:

> By authority of the Secretary of War, the Board of Officers of the Corps of Engineers constituted by Special Orders, No. 145, paragraph 6, War Department, Adjutant-General's Office, June 23, 1897, consisting of Col. Henry M. Robert, Maj. William T. Rossell, Capt. John Biddle (lieutenant-colonel, U. S. Volunteers), will reassemble at New York City October 7, 1898, for a further consideration of the subject before them.
>
> Upon the completion of the duty assigned them the members of the Board will return to their proper stations.
>
> The journeys required under this order are necessary for the public service.
>
> By command of Brig. Gen. Wilson:
>
> JOSEPH E. KUHN,
> *Captain, Corps of Engineers.*

In obedience to the above order the Board met at the Army Building, New York City, at 10 a. m., October 7, 1898; present, all the members. The Board remained in session until October 14, when it adjourned.

On assembling the president of the Board presented a letter from the Chief of Engineers, United States Army, dated Washington, D. C., October 1, 1898, directing the Board to make a report, as required by the concurrent resolution of May 26 and 28, 1898, which reads as follows:

> [Fifty-fifth Congress, second session. Congress of the United States. In the House of Representatives, May 26, 1898.]
>
> *Resolved by the House of Representatives (the Senate concurring)*, That the Secretary of War be, and he is hereby, authorized and directed to prepare and submit plans, specifications, and estimates for the improvement of Aransas Pass Harbor, State of Texas, and especially to make plans and estimates for the removal of the sand bar at Aransas Pass and the deepening of the channel across said bar to a depth of at least twenty feet and a width of at least one hundred and fifty feet at the bottom, so as to furnish an inlet for the passage of vessels from the Gulf of Mexico into Aransas Harbor, and report such plans to Congress, and also whether, in his judgment, such improvement should be made.
>
> Attest: A. MCDOWELL, *Clerk.*
>
> [In the Senate of the United States, May 28, 1898.]
>
> *Resolved*, That the Senate agree to the foregoing concurrent resolution of the House of Representatives.
>
> Attest: WM. R. COX, *Secretary,*
> By J. S. MCE[illegible], *Chief Clerk.*

The Board examined all maps, plans, and reports heretofore made on Aransas Pass and Harbor which were in its possession. After a careful consideration of the subject it was decided that general plans and estimates for the improvement could be made with the data at its disposal. The Board, prior to making its report on Aransas Pass of November 22, 1897 (House Doc. No. 137, Fifty-fifth Congress, second session), twice visited the pass, and consequently the members were personally familiar with the locality. The plans and estimates herewith submitted are subject to modification should a survey made at the time work is to be done show material changes in the conditions.

The Board is of the opinion that in order to improve Aransas Pass it will be necessary to both remove the sand bar at the mouth and to extend the shore protection heretofore built on the head of Mustang Island. To protect the head of Mustang Island, they propose to extend the riprap, used with success heretofore, and estimate the amount of stone necessary for this at 30,000 tons.

To remove the sand bar at Aransas Pass and deepen the channel across said bar to a depth of at least 20 feet and a width of at least 150 feet at the bottom, it will be advisable to build two parallel jetties and to have recourse to dredging.

Conditions existing at Aransas Pass lead the Board to recommend that the north jetty be located essentially upon the line of the jetty partially constructed by the Aransas Pass Harbor Company, and that the south jetty be constructed about 1,200 feet south thereof. It is proper to remark that the Board would have preferred a more northerly location for the sea end of the channel and a greater distance between jetties, were it not for the great difficulty of removing all of the material now constituting the jetty of the Aransas Pass Harbor Company so thoroughly as to insure that nothing would be left that might possibly interfere with suction dredges working over its site.

A portion of the old Government jetty and the outer 1,000 feet of foundation of the Aransas Pass Harbor Company's jetty must be removed in any case.

The proposed jetties should extend to the 20-foot curve with an apron in advance. In order to prevent scouring, it is proposed to connect the inner end of the existing curved jetty with St. Joseph Island by means of a rock sill. Under ordinary circumstances there is probably no danger from scour, but it has been deemed prudent to provide in the estimate for this contingency by allowing for a rock sill 40 feet wide and 3 feet deep. It is assumed that this will settle into the sand so that none of it will be above low water to interfere with the inflow of the flood tide.

For the remainder of the work the tops of the jetties will be 4 feet above mean low water, with a top width varying from 10 to 20 feet, according to the depth, with side slopes of one on one and a half, and an apron 18 feet wide and 3 feet thick on the channel side to prevent undermining.

The jetties are to be entirely of rock—the interior of ordinary run of quarry and the outer portion of blocks weighing from 2 to 10 tons each.

It is the opinion of the board that the interests of navigation demand that the bottom width of the 20-foot channel between the jetties should be at least 300 feet. Allowing this channel to have side slopes of about one on thirty, about a million cubic yards of sand would have to be removed. While doubtless a large part of this would be accomplished by scour in the case of severe storms, it has been deemed expedient to provide for removing three-fourths of this material by dredging. This will enable the channel to be opened quickly without waiting for the completion of the jetties and the afterscour. The estimated cost of carrying out this project is as follows:

Shore protection, 30,000 tons of rock, at $3	$90,000
North jetty, 200,000 tons of rock, at $3.25	650,000
South jetty, 140,000 tons of rock, at $3 25	455,000
Dredging 750,000 cubic yards, at 20 cents	150,000
Engineering contingencies	180,000
Total	1,525,000

Twenty-five per cent has been added to the net estimate of the quantity of stone for consolidation and settlement. The cost of removing the required portion of the old Government jetty is included in the estimate for contingencies. The cost of removing the 1,000 feet of foundation of the Aransas Pass Harbor Company's jetty is included in the cost of the jetties.

In all official reports heretofore made the Aransas Pass has been declared worthy of improvement. Two railroads—the San Antonio and Aransas Pass Railroad and the Mexican National Railroad—terminate here or in the vicinity, so that this pass could be used in connection with their terminal. There is no good harbor available nearer than the mouth of the Brazos River, more than 100 miles distant, while there is a large territory tributary to Aransas Pass Harbor. The board is of opinion that Aransas Pass Harbor is worthy of immediate improvement.

The board desires further to call attention to the narrow and shallow channel connecting Aransas Pass with the town of Corpus Christi, the terminal of the San Antonio and Aransas Pass and the Mexican National Railroad. The board believes that the channel through Turtle Cove connecting Aransas Pass and Corpus Christi should be dredged to a depth of 12 feet at mean low water, 150 feet wide at the bottom, with side slopes of 1 on 5. Such a channel, it is estimated, will cost about $215,000.

Accompanying this report is a tracing showing the proposed plan of improvement.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.
WM. T. ROSSELL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

V 15.

ESTIMATES OF COST OF IMPROVING MOUTH OF BRAZOS RIVER, NEAR VELASCO, TEXAS.

[Printed in Senate Doc. No. 108, Fifty-fifth Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, February 6, 1899.

SIR: I have the honor to acknowledge the receipt of a resolution of January 28, 1899, of the Senate of the United States, directing the Secretary of War to submit a report of survey and estimates for the improvement of the mouth of the Brazos River near Velasco, Tex., with such information as may be in his possession for the improvement thereof by continuing the work done by the Brazos River Channel and Dock Company, or otherwise, with probable cost, and such other information as he may have in connection with the proposed improvement.

In answer to the reference of the resolution to this office for report, I beg leave to submit the accompanying copy of a report of February 2, 1899, from Col. H. M. Robert, Corps of Engineers, president of the board of engineers appointed under the provisions of the river and harbor act of June 3, 1896, to ascertain the character and value of the improvements at the mouth of the Brazos River.

This report of Colonel Robert now submitted presents the information called for by the resolution, and he estimates that the dredging required would cost $85,000. He states:

> It is not to be supposed that when the channel is dredged it will be maintained without further dredging. Annual dredging will be necessary, at a cost that experience alone must determine. It would be reasonable to assume that as much as $20,000 would be required.

Section 4 of the river and harbor act of June 3, 1896, provides—

> that no preliminary examinations, survey, project, or estimate for new works other than those designated in this act shall be made: *And provided further*, That after the regular or formal report on any examination, survey, project, or work under way or proposed is submitted, no supplemental or additional report or estimate for the same fiscal year shall be made unless ordered by a concurrent resolution of Congress—

and in the absence of the concurrence of the House of Representatives in the action of the Senate in the adoption of the inclosed resolution it would seem that the presentation to Congress of the report now submitted is prohibited by law.

The resolution of the Senate is herewith returned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

NEW YORK CITY, *February 2, 1889.*

GENERAL: In response to your indorsement of February 1, 1899, furnishing a copy of Senate resolution of January 28, 1899, which directs the Secretary of War to submit a report of survey and estimates for the improvement of the mouth of the Brazos River near Velasco, Tex., etc., I have the honor to state that the data in my possession, collected by the Board on the Brazos River, of which I was president, appointed under the provisions of the river and harbor act of June 3, 1896, are sufficient to enable such reports and estimates to be made, and I therefore submit the following information on the subject of the resolution:

The Brazos River Board had a very detailed survey made of the Brazos River from its mouth up to and beyond Velasco, Tex. This survey was made under the direction of Mr. H. L. Marindin, of the Coast and Geodetic Survey. In the report of the Board (p. 8 of Senate Doc. No. 138, Fifty-fourth Congress, second session) it is stated that—

> * * * the jetties alone can not maintain a channel depth of over 15 feet at mean low tide. To secure more than this at all seasons will require a resort to dredging.
>
> The survey just made also brings out the fact that in the river about a mile above the shore end of the jetties there is a shoal several hundred feet long on which the ruling depth is only 14.3 feet. This bar is shown on the Coast Survey chart of 1889, since which time it appears to have remained substantially unchanged. Its removal will no doubt require dredging. A half mile farther up the river is another bar with a ruling depth of 13.7 feet at mean low water. Mr. Marindin's survey shows that 2 miles of dredging would be required to give a navigable channel 16 feet depth up to Velasco, one-half of this being at the entrance between the jetties and just above.

On page 11 of the same report is found the following:

> There can be no doubt that the opening of the Brazos River to navigation by small boats and barges and the establishment at its mouth of a port for vessels drawing 18 or 20 feet would reduce the rates for transportation throughout the whole valley, not only on the freight actually carried by the river, but also upon all which might be thus carried, even though it might actually go by rail. The lowest rate made by any transportation line must be the rate for all. It is also highly probable, as stated by Mr. Foster, that such a port would become the terminus of new lines of railway, and thereby become an important factor in commerce without any reference to the navigation of the river. The commerce which has already come to

Velasco, in spite of the uncertain and unfavorable conditions which have there prevailed, is an evidence of this. So that in the judgment of the board there are valid commercial reasons for opening the mouth of the Brazos if it can be successfully done.

Upon the feasibility of such an opening as an engineering question, the Board, though of the opinion that a series of observations running through a period of low water in the river is very desirable, is inclined to answer in the affirmative. In times of low water in the river dredging will no doubt be required, but the appliances for this purpose have, during recent years, been so greatly improved that the cost of such work has been largely reduced. This reduction will be still greater from the fact that the work can probably be done with the same plant which the Government will have to maintain for Galveston. The experience of the last eight years has made it reasonably certain that, with the aid of dredging, the maintenance of a channel at the mouth of the Brazos with 18 feet depth at mean low tide is practicable. Whether more than this can be accomplished without an unreasonable expense the Board is not prepared to say.

The Brazos River Board did not make any project for the improvement of the Brazos River, as that had not been called for, but it was evidently the opinion of the Board that the proper way to further improve the mouth of the river was by dredging. The survey made was very detailed and furnishes all the information required for future work of improvement. If a channel 18 feet deep at mean low water were dredged for a width of 150 feet from the 18-foot curve in the Gulf up to the light-house, and thence up to Velasco for a width of 100 feet, it would provide all that commerce demands at present, and in fact all that the board stated they were sure could be maintained. Allowing the dredging to average a foot depth below the channel to be maintained, and making allowance for scow measurement, it will require the dredging of 500,000 cubic yards of material to provide this channel. I would estimate the cost at 15 cents per cubic yard, or a total of $75,000. Allowing for superintendence and contingencies, I would estimate the cost of the improvement mentioned at $85,000. It is estimated that if the work were done by the aid of Government dredges one-third of the cost would be saved.

I would call attention to the fact that the Brazos River board in its report (p. 12) stated that in its opinion the carrying out of the offer on the part of the Brazos River Channel and Dock Company to dedicate 1 mile of river front to the public "should be a condition precedent to any assumption of responsibility for the maintenance of the harbor by the Government." The offer of the company is found on page 63 of the above-mentioned report. I would recommend that the first act appropriating funds for this improvement should contain a proviso that none of the appropriation should be expended until 1 mile of river front be dedicated to the public in accordance with the offer of the Brazos River Channel and Dock Company dated February 15, 1897.

If this dedication is made the Board states as its opinion "that the maintenance of the harbor will be of a sufficient public interest to justify the Government in undertaking to complete the works and to maintain the channel at as great a depth as may be found practicable and as the interests of commerce may demand."

It is not to be supposed that when the channel is dredged it will be maintained without further dredging. Annual dredging will be necessary, at a cost that experience alone must determine. It would be reasonable to assume that as much as $20,000 would be required.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

APPENDIX W.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, AND MISSISSIPPI, TRIBUTARY TO MISSISSIPPI RIVER; WATER GAUGES ON MISSISSIPPI RIVER AND ITS PRINCIPAL TRIBUTARIES.

REPORT OF MAJOR J. H. WILLARD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Red River, Louisiana, Arkansas, and Indian Territory.
2. Red River above Fulton, Arkansas.
3. Cypress Bayou, Texas, and Louisiana.
4. Ouachita and Black rivers, Arkansas and Louisiana.
5. Bayou Bartholomew, Louisiana and Arkansas.
6. Bœuf River, Louisiana.
7. Tensas River and Bayou Maçon, Louisiana.
8. Yazoo River, Mississippi.
9. Mouth of Yazoo River and harbor at Vicksburg, Mississippi.
10. Tallahatchie River, Mississippi.
11. Big Sunflower River, Mississippi.
12. Water gauges on Mississippi River and its principal tributaries.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., July 1, 1899.

GENERAL: I have the honor to transmit herewith annual reports upon works of river improvement in my charge for the fiscal year ending June 30, 1899.

Very respectfully, your obedient servant,

J. H. WILLARD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

W 1.

IMPROVEMENT OF RED RIVER, LOUISIANA, ARKANSAS, AND INDIAN TERRITORY.

During the period July, 1898–February, 1899, no work for general improvement of Red River could be done, as the balance of former appropriations available for the purpose was barely sufficient for the care of plant. Minor repairs were made, so far as practicable, by the limited force retained upon the United States fleet at Shreveport, but the snag boats, etc., deteriorated considerably.

After receiving notification of the appropriation by river and harbor act of March 3, 1899, preparations were made at once to put the boats in condition for service below and above Shreveport. The snag boat

C. W. Howell has not been docked since it was launched in 1881, and eighteen years' hard service in the alkaline waters of Red River put the iron bottom of the vessel in very bad condition. Capt. M. B. Lydon, the master of the *Howell*, a very careful and competent man, thought, however, that the boat could be put in shape for immediate pressing service at a moderate outlay, and that the matter of new plating and general overhauling might be deferred until next winter. The bottom of the vessel inside was covered with 2 inch plank, with fore and aft cross pieces, and stanchions, 4 by 4 inches, from this sheathing to main deck were wedged in place to stiffen and strengthen the worn iron bottom of the boat. The rudders, smokestacks, breeching, and stumps, furnace, etc., also were overhauled and repaired. This work was completed April 13.

April 14–29 operations were carried downstream from Shreveport to Poland Cut-off, Louisiana, a distance of 233 miles, and all obstructions in the way or navigation were removed. Work could not be continued to advantage below Poland Cut-off on account of the high stage caused by the flood of the Lower Mississippi, and the boat worked back to Shreveport, reaching that city May 20, where new shears were erected at the bow and some minor repairs made.

I visited Shreveport May 24, where I was joined by the chief State engineer of Louisiana, H. B. Richardson, Assistant State Engineer F. M. Kerr, and Messrs. Bell and Jeter of the Caddo and Bossier levee boards. May 25–26 we proceeded on the *Howell* to the Hervey Canal Levee, on right bank of Red River about 54 miles above Shreveport. After inspecting and receiving that piece of contract work the inspection trip was continued upstream through the old raft region to the Louisiana and Arkansas line 69 miles above Shreveport, and then down to the Choctaw Bayou Levee, about 35 miles below Alexandria, reaching the latter place May 29.

May 31–June 7 the *Howell* worked over the river back to Shreveport. Supplies were taken aboard at Shreveport, and June 9–20 operations were continued upstream 59 miles to Kountz Canal. On the latter date, while employed in removing an old log heap just below the canal by means of the sweep chain, the pinions of both capstans were stripped, and after running to the Sale and Murphy Dam, 66 miles above Shreveport, and removing the growth of saplings and brush upon that structure, the *Howell* returned to Shreveport, reaching that city at 8 p. m., June 21.

New gear wheels for capstans were procured, minor repairs were made, and June 27 the boat left Shreveport to resume work in the upper river, which to June 30 had been carried to Dobson, Ark., 41¾ miles below Fulton.

The *Howell* passed through the bridge of the St. Louis Southwestern Railway Company at Garland, Ark., June 30, on a stage of 8.8 feet falling by the Garland gauge, and the master reported that the channel through the draw opening has been much improved by the work of the railway company at that place performed under authority of the Secretary of War, dated September 14, 1898.

The following is a summary of the work done by the snag boat *Howell*, April 14–June 30, 1899, viz:

Snags pulled	599
Stumps pulled	153
Shore snags cut	1,741
Logs removed from channel	4,299
Side jams removed	3
Leaning trees felled	856
Hard clay points cleared and removed with explosives	4

The small wooden snag boat *Columbia*, Robert Elflein, master, was repaired at Shreveport and commenced work in the river above that city April 19, which was carried upstream to Fulton May 12. Frequent oscillations of the river prevented thorough work for the removal of channel obstructions.

The following is a summary of the work done April 19–May 12, viz:

Snags pulled	227
Stumps pulled and destroyed	48
Shore snags cut	211
Logs cut	7
Side jams removed	3
Leaning trees felled	1,016
Trees girdled	45
Square yards of willows and brush cut	447

The boat was employed above Fulton, Ark., May 13–31, and then returned to Shreveport on account of a rapid rise. June 10 it was ordered to Vicksburg for work in Big Sunflower River, Mississippi.

CONSTRUCTION OF LEVEES.

My project of July 19, 1898, for levee construction under an allotment from the appropriation made by river and harbor act of June 3, 1896, for improving Red River, Louisiana and Arkansas, was approved by the Chief of Engineers August 5, 1898, and the following works were authorized, viz:

To construct a part of Choctaw Bayou Levee in cooperation with the Louisiana State board of engineers.

To extend the levee work on Red River from Station 125 of the Red Bayou Levee (built by the United States in 1895–96) upstream to Station 220, and above that point if available funds would permit.

Choctaw Bayou Levee is along the right bank of Red River in Avoyelles Parish, La., extending from a point about 432¼ miles below Fulton to a point about 437.3 miles below Fulton. Proposals for its construction were invited by advertisement of the governor of Louisiana, dated July 20, 1898, published in the official journal of the State, and by circular copies distributed to various levee contractors known to the State engineers. Bids were opened at the office of the board of State engineers, New Orleans, La., at noon August 10, 1898, six having been received, ranging in price from 9¼ to 14 cents per cubic yard, as shown upon the abstract appended to this report. A formal contract for the work was entered into August 12, 1898, between the governor of Louisiana and Mr. J. Thomas, the lowest bidder, and August 23, on behalf of the United States, I agreed by letter to pay him at the same rate for work from stations 0 to 100 of the levee.

The contractor commenced work August 24, 1898, and completed it January 1, 1899, the line being 25,470 feet long. Construction of the portion built by the United States was supervised by Inspector George C. Schoenberger.

Final measurements showed the work as completed to be as follows:

	Cubic yards.
Portion built by the United States between stations 0 and 100	66,445
Portion built by the State of Louisiana between stations 100 and 254+70	79,304
Total embankment built	145,749

Hervey Canal Levee, along right bank of Red River, in Caddo Parish, La., is an extension upstream of the Coushatta and Hervey Canal Levee, built by the United States in 1895–96, beginning at the terminus of the Red Bayou section, about 4,400 feet below Hervey Canal and about 54 miles above Shreveport. The work was advertised August 11 and bids were opened at this office by me at noon August 31, 1898. Three bids were received, ranging in price from 14.8 cents to 18.98 cents per cubic yard, and a fourth bid at 19.94 cents per cubic yard was received after the time set for opening. An abstract of the bids is appended to this report. The line was even more difficult than that of Red Bayou section, immediately below it, running the entire way through the woods, which had to be cleared by the contractor for a distance of 100 feet from the base of the levee on both sides, and the stumps grubbed for 3 feet beyond the slope stakes. As the locality is difficult of access, wild in character, barren of labor, and infested by insects harassing and injurious to stock, levee contractors generally did not care to bid. The award was made to the lowest bidders, Messrs. W. J. Bentley & Co., of New Orleans, La. The contract required that the work should be completed by December 31, 1898, but on account of unavoidable delays, caused by prevalence of yellow fever in Louisiana and Mississippi and subsequent unfavorable conditions for levee work, four extensions of time were authorized, the last being to May 31, 1899.

The contractors commenced work September 15, 1898, and completed the levee May 18, 1899. The length of the line built was 10,006 feet, and the cost of the work, exclusive of superintendence and inspection, as follows:

247,400 cubic yards of levee embankment, at 14.8 cents per cubic yard ..	$36, 615. 20
Extra work required in excavating below grade (5,265 cubic yards) to obtain secure foundation for line of embankment crossing Hervey Canal.	1, 376. 02
Building pile bulkhead at station 225, the upper terminus of levee	450. 00
Bridging traverse ditches opposite ramps crossing the levee............	20. 50
Total..	38, 461. 72

The work was done under the local supervision of Inspector John J. Hoopes.

A statement of the levee work done by the State of Louisiana during the fiscal year, furnished by the board of State engineers, is appended hereto.

Under provisions of river and harbor acts of 1892 and 1894 a plan for improvement of Red River was authorized to include "construction of a substantial system of levees to restrain the greatest floods, either alone or in partnership with the riparian States," for the purpose of confining the river to the adopted channel, thereby improving and giving ease and safety to navigation. This system was begun by the United States in 1892 in conjunction with the State of Louisiana and local levee districts, and it has been the endeavor to put the levees built or enlarged up to a grade about 3 feet above the highest flood of record. The total work done is shown in the following table:

Statement of levee work on Red River built by the United States since 1892.

Fiscal year.	Miles of new work.	Miles of enlargement.	Cubic yards built.	Cost.
1893..	3. 60	....	324, 323	$43, 631. 73
1894..	....	1. 16	21, 000	4, 788. 00
1895..	2. 55	....	261, 455	37, 623. 44
1896..	2. 60	4. 58	354, 721	48, 996. 16
1899..	3. 79	....	318, 845	42, 816. 73
Total	12. 54	5. 74	1, 275, 344	182, 856. 06

Statement of levee work on Red River built by the State of Louisiana and local levee districts since 1892.

Fiscal year.	Miles of new work.	Miles of enlargement.	Cubic yards built.	Cost.
1893	58.80	12.80	2,921,765	$503,021.73
1894	12.00	25.00	1,095,789	136,086.22
1895	20.20	13.10	973,867	122,478.16
1896	5.21	13.83	482,411	57,226.59
1897	5.31	15.23	536,988	47,820.77
1898	6.01	2.34	371,914	42,185.39
1899	9.81	3.54	509,640	52,840.65
Total	117.34	85.84	6,892,374	961,659.51

The work of the United States is part of a system to improve navigation, and that of the State engineers and the levee boards is for protection of fertile lands from overflow. But while the work done by the United States is a comparatively small percentage of the whole it has served to direct action of the State engineers in planning their portions of the system to no small extent, and it operations could be continued in the same way for a few years the levee lines within Caddo and Bossier districts would be completed at a relatively moderate charge to the United States. The people of those districts, however, have taxed themselves for levees almost to impoverishment, anticipating revenues of future years to push the work, and their means are exhausted for the present.

Three levee districts along Red River have been created by acts of the Louisiana legislature, viz:

1. The Caddo Levee district, including alluvial lands subject to overflow from Red River, its tributaries and outlets in the parish of Caddo, created by act No. 74, approved July 6, 1892.
2. The Bossier Levee district, embracing the alluvial lands subject to overflow from Red River and its tributaries or outlets within certain limits of Bossier Parish, created by act No. 89, approved July 6, 1892.
3. The Red River, Atchafalaya, and Bayou Bœuf Levee district, created by act No. 79, approved July 5, 1890, includes territory subject to overflow from Red River, Bayou des Glaizes, and Atchafalaya River in Rapides, Avoyelles, and part of St. Landry parishes.

As yet there are no organized districts for the stretch below the Caddo and Bossier districts to Rapides Parish.

All the work done by the United States is within the Caddo and Bossier districts, except a short stretch required to connect the line above the Sale and Murphy dam with the hills in Arkansas, and that portion of the Choctaw Bayou Levee built last fall and winter, in Avoyelles Parish, in the Red River, Atchafalaya, and Bayou Bœuf district.

The present extent of lines of public levees along Red River is summarized as follows:

1. From Blanton Bluff, Lafayette County, Ark., to and across Sale and Murphy Canal, Caddo Parish, La., a length of line down right bank of 3 miles.
2. From a point about 1 mile above Hervey Canal to Soda Fount plantation, a length of line down right bank in Caddo Parish, La., of 29.5 miles.
3. From upper side of Bayou Pierre to upper side of Tones Bayou, a length of line down right bank in Caddo Parish, La., of 12.5 miles.
4. From a point in Caddo Parish 9 miles below Tones Bayou to near Bayou La Chute, in Red River Parish, La., a length of line up Bayou

Pierre and Tones Bayou, left bank, and down Red River, right bank, of 36 miles. About 9 miles of upper end of this line (on Bayou Pierre) and about 2 miles at the lower end (in Red River Parish) were built by private parties and are not considered as district levees.

5. From the highlands near Hurricane Bluff to Buckhorn plantation, a length of line down left bank in Bossier Parish of 55 miles.

6. From a point on Bayou Rapides about 2.5 miles above Alexandria to the highlands at David Ferry, Avoyelles Parish, La., a length of line down Bayou Rapides and Red River, right bank, of 42.5 miles.

Other lines of levee, built chiefly by riparian owners to partially protect small areas from overflow, occur at a number of points along both banks of Red River, but they are not of sufficient extent or importance to be included in connection with the lines of public levee.

In my judgment, the works of first importance to aid in improving the navigation of Red River are the extension of the line in Caddo Parish northward from the Hervey Canal Levee to the Sale and Murphy dam, closing the gap in that line and completing the closure of all outlets along the right bank; the final closure of Tones Bayou Outlet below Shreveport, for which nothing has been done since 1882, and the restoration of slopes and resodding the Choctaw Bayou Levee. That levee was in fine shape when completed and accepted last January, but soon after, and before the Bermuda grass got a fair start, a succession of heavy rains washed it considerably; the excessive cold of last winter killed much of the grass, and its growth this summer has been retarded by long drought.

Statement showing levee work on Red River undertaken by the State of Louisiana and local levee districts from July 1, 1898, to June 30, 1899.

[Prepared by request for Maj. J. H. Willard, Corps of Engineers.]

Name of contract.	Parish.	Below Fulton.	Date of—		New levee.	Enlargement.	Quantity.	Price per cubic yard.	Cost.	Per cent of work done.
			Contract.	Final certificate.						
Caddo Levee district.		*Miles.*			*Linear feet.*	*Linear feet.*	*Cubic yards.*	*Cents.*		
Cairo	Caddo	161 -162.75	Aug. 11, 1898	Jan. 20, 1899	7,125		52,212	9	$6,245.91	100
Hurricane Bluff section	do	159.25-161	do		2,708	2,281	17,187			
Bayou Pierre enlargement	do	190 -195	Nov. 15, 1898		1,855	15,305	91,635	10.45	13,233.85	100
Levy section	do	203 -203.5	do		2,581	1,100	35,000			
Total					14,269	18,686	196,034		19,479.26	
Bossier Levee district.										
Taylor	Bossier	166.75-167.25	Aug. 10, 1898	Nov. 18, 1898	1,867		9,499	7.9	750.42	100
Riverside[a]	do	172 -173	Feb. 15, 1899		8,340		118,500	13.2	15,642.00	75
Shady Grove	do	176 -176.5	Nov. 22, 1898	May 8, 1899	3,460		45,574	9	5,180.58	100
Cash Point section	do	175.25-175.75	do		1,816		11,988			
Total					15,483		185,561		21,573.00	
Red River, Atchafalaya, and Bayou Bœuf Levee district.										
Williams	Rapides	398.25-399.75	Nov. 15, 1898	Apr. 14, 1899	6,600		48,741	9	4,386.69	100
Choctaw Bayou	Avoyelles	432.25-437.3	Aug. 12, 1898	Jan. 7, 1899	15,470		79,304	9¼	7,401.70	100
Total					22,070		128,045		11,788.39	
Total work undertaken during the year					51,822 (9.81 miles)	18,686 (3.54 miles)	509,640		52,840.65	

[a] Built by Bossier Levee district. All other work built by the State.

Respectfully,

THE BOARD OF STATE ENGINEERS,
Per F. M. KERR, *Assistant State Engineer.*

OFFICE BOARD OF STATE ENGINEERS, *New Orleans, La., June 8, 1899.*

ALEXANDRIA.

No special work was done in the Alexandria reach during the fiscal year.

The appropriation for improving Red River contained in river and harbor act approved March 3, 1899, provides that "an examination shall be made of the harbor of Alexandria, and a report as to what improvement, if any, should be made thereof, together with an estimate of the cost thereof." I visited Alexandria in May, 1899, while making a general inspection, but the lower river was high at the time, and the varying stages since the act became a law have not afforded a favorable opportunity for the examination called for, which it is proposed to make during the usual protracted low-water period in the autumn.

SULPHUR RIVER.

No work for improvement of this tributary of Red River was done during the year.

Gauge observations at the mouth were discontinued April 1, 1899.

ESTIMATES.

Additions to plant	$50,000
Care of plant and ordinary repairs	15,000
New bottom for snag boat *Florence*	5,000
Service of plant, snag boats, etc	50,000
Levees	550,000
Local surveys, maps, and gauges	10,000
Administration and contingencies	5,000
Continuing snagging operations, etc., above Fulton	5,000
Total	690,000

Money statement.

July 1, 1898, balance unexpended	$74,525.77
Amount appropriated by river and harbor act approved March 3, 1899	150,000.00
	224,525.77
June 30, 1899, amount expended during fiscal year	58,535.72
July 1, 1899, balance unexpended	165,990.05
July 1, 1899, outstanding liabilities	152.52
July 1, 1899, balance available	165,837.53
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	690,000.00

The amounts expended during the year and balances July 1, 1899, were as follows:

Allotments.	Expended during year.	Balances July 1, 1899.
For general improvement, repairs, and care of plant, etc	$8,256.21	$93,532.57
For Little River, from Scopini Cut-off to Knox Point (act September 19, 1890)	1,294.78	6,413.63
For construction of levees	48,894.73	63,532.84
For Sulphur River (act August 18, 1894)	90.00	2,511.01
Total	58,535.72	165,990.05

The appropriations for the early work, from 1828 to 1852, were as follows:

Date of act.	General object of appropriation.	Amount.
May 23, 1828	Improving navigation of Red River through or around the raft in Louisiana and Arkansas	$25,000.00
Mar. 2, 1831	Arrearage due Major Burch for survey of raft of Red River, Louisiana	187.50
July 3, 1832	Improving navigation of Red River, Louisiana and Arkansas, being balance of appropriation of 1828 carried to surplus fund, and the further sum of $20,000	22,628.00
June 28, 1834	Improving navigation of Red River	50,000.00
Mar. 3, 1835	Completing removal of obstructions to navigation of Red River	50,000.00
July 2, 1836	Continuing the removal of obstructions in Red River	40,800.00
	Constructing a boat to prevent a new accumulation of obstructions in Red River within the old limits of the great raft, $15,000, and to work and support same, $15,000	30,000.00
Mar. 3, 1837	Continuing the removal of obstructions in Red River	65,000.00
Apr. 20, 1838	The complete removal of the great raft in Red River	70,000.00
Mar. 3, 1841	Removing the raft of Red River	75,000.00
Mar. 2, 1847	Deficiency of appropriation by act of April 20, 1838, being amount advanced by Daniel T. Witlee and others through the branch of the Real Estate Bank of Washington, Ark., to Henry M. Shreve, Government agent, for removal of great raft and expended by him for that purpose	7,150.00
Aug. 30, 1852	Removing the raft of Red River	100,000.00
	Aggregate of appropriations, 1828–1852	535,765.50
	Amount expended	532,219.90
	Amount carried to surplus fund	3,545.60

The appropriations since 1872 have been as follows:

Date of act.	General object of appropriation.	Amount.
June 10, 1872	Improvement of Tones Bayou, Louisiana	$20,000
	Removing the raft in Red River, Louisiana	150,000
Mar. 3, 1873	....do	80,000
June 23, 1874	....do	50,000
Mar. 3, 1875	....do	20,000
Aug. 14, 1876	Removing the raft in Red River and closing Tones Bayou	85,000
Apr. 10, 1869	Allotment made August 27, 1877, for closing Tones Bayou	4,500
Feb. 7, 1878	Opening navigation of Red River above Shreveport, La., and keeping same open and free from rafts, and for the purpose of preserving vessels of the United States employed in that work	6,000
June 18, 1878	Removing raft in Red River and closing Tones Bayou	24,000
	Removing snags and other obstructions from Red River	25,000
Mar. 3, 1879	Removing raft in Red River and closing Tones Bayou	15,000
	Removing obstructions from Red River	22,500
	Improving upper Red River, Arkansas, from Fulton to head of the raft	10,000
June 14, 1880	Removing raft in Red River and closing Tones Bayou	25,000
	Removing obstructions from Red River, Louisiana, including construction of snag boat	60,000
	Improving upper Red River, Arkansas, from Fulton to head of the raft	10,000
Mar. 3, 1881	Removing raft in Red River and closing Tones Bayou	10,000
	Removing obstructions from Red River, Louisiana	10,000
Aug. 2, 1882	Continuing improvements from the Atchafalaya to Fulton, Ark., including Bayou Pierre, Tones Bayou, and to relieve the town of Alexandria from encroachments of the river	75,000
July 5, 1884	Continuing improvement from the Atchafalaya to Fulton, Ark.; not exceeding $15,000 for revetment to protect the harbor at Alexandria from damage by the current of river; not exceeding $5,000 to close the outlet known as Sale and Murphy Canal; the remainder to be applied to improvement of the main channel of the river	75,000
Aug. 5, 1886	Continuing improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, including completing the work at Alexandria; $25,000, or so much thereof as necessary, to be used in making a thorough survey of the river from Fulton to the Atchafalaya and in completing survey of Bayou Pierre, Louisiana	75,000
Aug. 11, 1888	Continuing improvement from Fulton, Ark., to the Atchafalaya River, including completing the work at Alexandria; $5,000, or so much thereof as necessary, to be used upon Cypress Bayou and the lakes between Shreveport, La., and Jefferson, Tex., and $5,000, or so much thereof as necessary, upon Bayou Dorcheat	65,000
	Completion of survey from Fulton, Ark., to the Atchafalaya River	35,000
Sept. 19, 1890	Continuing improvement from Fulton, Ark., to the Atchafalaya River; $15,000 to be used in the work at Alexandria; $20,000 to be used in deepening and widening that portion known as Little River, from the Scopini Cut-off to Knox Point, and $5,000 in closing the Sale and Murphy Outlet.	100,000
	Completion of survey from Fulton, Ark., to the Atchafalaya River	28,000

Date of act.	General object of appropriation.	Amount.
July 13, 1892	Continuing improvement from Fulton, Ark., to the Atchafalaya River, according to plan of Capt. J. H. Willard, Corps of Engineers, and for completion of survey, including the work at Alexandria, the widening of that portion known as Little River, the necessary work at the harbor at Shreveport, the closing of outlets on the west bank of the river above Shreveport, and the removal of the towhead just above Rush Point, Caddo Parish (of which $5.000 may be used, in the discretion of the Secretary of War, for work in Cypress Bayou and the lakes between Shreveport, La., and Jefferson, Tex.)	$145, 000
Aug. 18, 1894	Continuing improvement from Fulton, Ark., to Atchafalaya River, according to plan of Capt. J. H. Willard, Corps of Engineers, and for completion of survey; $15,000, or so much thereof as necessary, to be used in further prosecution of work at Alexandria, and $5,000 for improving Sulphur River, a tributary of Red River	150, 000
June 3, 1896	Continuing improvement from Fulton, Ark., to Atchafalaya River	100, 000
Mar. 3, 1899	Continuing improvements from Fulton, Ark., to Atchafalaya River, and above Fulton to mouth of Kiamichi River, Indian Territory; and requiring an examination of harbor at Alexandria, La	150, 000
	Aggregate of appropriations 1872 to 1899	1, 575, 000

Abstract of proposals for constructing Choctaw Bayou Levee along Red River, in Avoyelles Parish, La., received in response to advertisement of the governor of Louisiana dated July 20, 1898, and opened at New Orleans, La., at noon, August 10, 1898, by the board of State engineers.

No.	Name of bidder.	Price per cubic yard.
		Cents.
1	Wm. Robson & Son	12.9
2	F. L. Casson	14
3	L. A. Bauman	13
4	Mike Tansey	9.87
5	M. L. Linnan	9.73
6	J. Thomas	*a* 9.33⅓

a Bid accepted.

Abstract of proposals for constructing levee on Red River at and above Hervey Canal, Caddo Parish, La., received in response to advertisement dated August 11, 1898, and opened at Vicksburg, Miss., at noon, August 31, 1898, by Maj. J. H. Willard, Corps of Engineers.

No.	Name and address of bidder.	Price per cubic yard.
		Cents.
1	Hunter Bros., Shreveport, La	18¼
2	W. J. Bently & Co., New Orleans, La	*a* 14.8
3	Cary & O'Brien, Memphis, Tenn	18.98
4	John Scott & Sons, St. Louis, Mo	19.94

a Bid accepted.

Bid No. 4 was received by mail August 31, 1898, at 12.45 p. m., and could not receive consideration.

COMMERCIAL STATISTICS.

The river was reported navigable in the fiscal year as follows: From Shreveport to Fulton, for light-draft boats, the entire year. Below Shreveport to the mouth there was good navigation for the largest packets, with exception of the period September 15–November 20, 1898. During the latter time New Orleans boats ran to Coushatta, La.

List of steamboats engaged in the trade during the fiscal year 1899.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft. Light.	Draft. Loaded.	Between—	Round trips.	Passengers.
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Sunrise	Stern-wheel.	473.31	200	45	6.5	2 4	7 6	New Orleans and Shreveport.	13	289
Valley Queen	...do	410.83	190.6	35.8	5.6	3 0	3 0	.....do	8	90
Electra	...do	372.88	190	40	5.2	2 4	5 6	.....do	26	304
W. T. Scovell	...do	244.8	160	31	3.7	2 0	5 6	.....do	23	162
Hallette	...do	196.8	161	30.5	4.5	2 0	5 6	.....do	4	42
Gem	...do	97	......	......	......	1 8	5 6	....do	9	89
								Shreveport and Elmer	21	76
								Shreveport and Sentell	16	.....
New Mary Morgan.	...do	135	112	22.8	3.3	1 6	3 0	Garland, Dooley Ferry, and Gibson, Ark.	(*a*)	(*a*)
Jo. Walker	...do	59.48	80.4	20	3	1 6	2 6	Shreveport and Whitehall.	45	(*a*)
G. W. Bolton	...do	89	80.9	12.4	4.1	2 2	3 6	Alexandria and Pineville Ferry.	....	5,000
Lillie M. Barlow	...do	49	......	......	......	1 8	3 0	Grand Ecore, Coushatta, Colfax, and Natchitoches.	53	.....
George L. Bass *b*	...do	53.82	91	21	3.3	1 8	3 6	Campti and Boyce	37	.....
U and I *b c*	...do	87	......	......	......	1 2	3 0	Charlotte and Red River Landing.	4	30
Waukesha	...do	77	105	24.4	3.0	1 0	2 6	Fulton and Shreveport	(*a*)	(*a*)
Linda *b*	...do	40	78.2	19.7	3.4	1 1	3 6	Shreveport and Red Bayou.	39	.....
Gus Fowler	...do	309.62	160	29.5	5.6	2 8	6 0	No report	....	.....
H. W. Graves *b*	...do	81.23	94.6	17.6	3	1 8	3 0	.....do	....	....
May Fisher *b*	...do	52.84	92	18.8	4	2 0	2 0	Alexandria and Baton Rouge.	2	.....
Trilby *b*	Tug	3	......	......	......	3 0	3 10	Alexandria and local points below.	3	.....
Lizzie Schenck	Yacht.	......	......	......	......	......	......	New Orleans and Alexandria.	1	.....

a No report.
b With one or more barges.
c The steamer U and I burned February 23, 1899, about 4 miles above Coushatta, La.

The Red River Line employs 8 model barges in connection with their boats.

Summary of commerce reported.

Articles.	1898–99.	1897–98.	1896–97.	1895–96.	1894–95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	22,228	18,173	15,941	13,204	18,308
Cotton seed	26,777	24,084	26,962	18,537	5,322
Cotton-seed meal	3,592	4,640	9,633	4,822	4,516
Live stock	7	52	15	55	49
Hides and skins	16	21	80	71	50
Lumber	4,000	3,297	643	1,570	1,657
Saw logs	11,000	9,000	12,885	18	20,000
Staves	2,417	630	4,084	380	697
Miscellaneous	2,321	3,392	1,770	2,285	3,000
Total down freight	72,358	63,289	72,013	40,942	53,599
Return freight	31,516	43,525	39,851	32,560	22,122
Total	103,874	106,814	111,864	73,502	75,721
Estimated value	$4,611,000	$4,307,000	$4,429,000	$3,833,000	$3,419,000

Summary of commerce reported—Continued.

Articles.	1893-94.	1892-93.	1891-92.	1890-91.	1889-90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	15,392	14,061	29,400	21,613	18,838
Cotton seed	4,402	7,902	31,832	12,249	14,140
Cotton-seed meal	9,042	4,713	....	10,000	....
Live stock	496	1,185	286	38	....
Hides and skins	31	62	151	212	35
Lumber	1,257	1,520	2,352	....	4,519
Saw logs	28,869	15,200	22,250	16,523	....
Staves	228	1,739	206	81	58
Miscellaneous	105,395	5,964	14,107	2,719	136
Total down freight	165,112	52,346	100,584	63,435	37,726
Return freight	63,518	17,605	19,942	30,051	28,650
Total	228,630	69,951	120,526	93,486	66,376
Estimated value	$6,061,000	$3,422,000	$6,877,000	$9,185,000	$6,820,000

In addition to the above report for 1898-99, from Ouachita River, entering Red River at mouth of Black River, 199,684 tons, the value of which is estimated at $6,121,000.

Receipts and shipments of bales of cotton at Shreveport, La.

	1898-99.	1897-98.	1896-97.	1895-96.	1894-95.
RECEIPTS.					
By rail	197,945	112,835	66,666	42,860	52,573
By wagon	39,468	42,437	31,768	31,474	54,968
By river	12,172	9,219	4,611	6,679	11,319
Warehouse receipts	249,585	164,491	103,045	81,013	118,860
SHIPMENTS.					
By Texas and Pacific Rwy	63,292	25,347	31,618	22,631	34,239
By Vicksburg, Shreveport and Pacific R. R	24,144	29,117	12,191	10,441	20,239
By Houston and Shreveport R. R	30,662	13,842	17,660	16,582	22,459
By St. Louis Southwestern Rwy	40,483	33,050	20,230	16,869	28,469
By Kansas City, Pittsburg and Gulf R. R	71,469	37,906	16,672	100	....
By river to New Orleans	14,290	12,682	8,327	14,102	10,654
Total	244,340	151,944	106,698	80,725	116,060

	1893-94.	1892-93.	1891-92.	1890-91.	1889-90.
RECEIPTS.					
By rail	30,033	25,277	44,256	39,890	25,476
By wagon	41,014	31,612	40,644	37,725	40,026
By river	5,581	4,821	9,189	14,836	8,897
Warehouse receipts	76,628	61,710	103,089	92,451	74,399
SHIPMENTS.					
By Texas and Pacific Rwy	25,019	26,904	36,645	23,811	23,690
By Vicksburg, Shreveport and Pacific R. R	10,546	10,384	23,251	15,564	20,813
By Houston and Shreveport R. R	13,429	3,114	5,353	13,860	12,529
By St. Louis Southwestern Rwy	17,817	7,818	24,187	15,039	8,820
By river to New Orleans	9,246	14,751	10,567	19,218	8,412
Total	76,057	62,971	100,003	86,992	74,264

The competing routes of transportation for the trade of Red River Valley, below Fulton, Ark., are as follows: The river is crossed by the St. Louis, Iron Mountain and Southern Railway at Fulton, Ark., by the St. Louis Southwestern Railway near Garland, Ark., by the Vicksburg, Shreveport and Pacific Railroad at Shreveport, La., and by the Houston, Central Arkansas and Northern Division of the Missouri Pacific Railway near Alexandria, La. The Shreveport branch of the St. Louis Southwestern Railway runs nearly parallel to the left bank from Shreveport, La., northward 61 miles to Lewisville, Ark., 8 miles east of Garland; the Kansas City, Pittsburg and Gulf Railroad, from Kansas City, Mo., to Port Arthur, Tex., crosses the river north of Texarkana, and then runs nearly parallel to the right bank to Shreveport; and the Texarkana and Shreveport Railroad, between the river and the Kansas City, Pittsburg and Gulf Railroad, is in operation from Texarkana southward 38 miles to Loma, La., within about 20 miles of Shreveport. Shreveport is the eastern terminus of the Houston and Shreveport Railroad; and the Sherman, Shreveport and Southern Railway, a branch of the Missouri, Kansas and Texas Railway, is building about 20 miles of road from Jefferson to Waskom, Tex., and from the latter place will enter Shreveport over the Vicksburg, Shreveport and Pacific Railroad. Below Shreveport the Shreveport and Red River Valley Railway, down the left bank of the river, is in operation for 56 miles to Grappes Bluff, La., and is building southward. The Texas and Pacific Railway runs nearly parallel to the right bank and touches the river at Alexandria, Boyce, Shreveport, and other points on the main stream, and at Jefferson, Tex., on Cypress Bayou, and connects with diverging roads at Texarkana. The Alexandria branch of the Southern Pacific runs southward from Alexandria 85 miles to the main line, and the Kansas City, Watkins and Gulf Railway runs from Alexandria southwest to the Southern Pacific, both connecting at Alexandria with the Missouri Pacific and Texas and Pacific railways.

W 2.

IMPROVEMENT OF RED RIVER, ABOVE FULTON, ARKANSAS.

The U. S. snag-boat *Columbia*, Robert Elflein, master, was employed in this part of Red River May 13–31, 1899. Operations were carried upstream to McNeelys, estimated to be about 65 miles above Fulton. As the river was falling more than a foot a day, and soundings showed but 3 feet depth upon the bars, the boat turned back May 20, to prevent being detained indefinitely by a low stage. The head and forward deck having been strained and weakened from handling heavy snags in this part of the river, the repairs needed were made at Fulton May 22–27, and on their completion work was resumed.

The following obstructions to navigation were removed, viz:

Snags in channel pulled and destroyed	97
Stumps pulled	1
Side jams removed	1

A rapid rise set in May 31, causing a stage too high to work to advantage, and the *Columbia* returned to Shreveport, La., to await a favorable time for resuming operations.

Money statement.

July 1, 1898, balance unexpended	$2,639.54
June 30, 1899, amount expended during fiscal year	583.99
July 1, 1899, balance unexpended	2,055.55

The appropriations have been as follows:

By act of—		By act of—	
August 5, 1886	$7,000	August 18, 1894	$3,500
August 11, 1888	3,000	June 13, 1896	3,000
September 19, 1890	2,000		
July 13, 1892	3,500	Total	22,000

The river and harbor act of March 3, 1899, provided for continuing operations above Fulton, under the general title "Improving Red River."

COMMERCIAL STATISTICS.

No commerce was reported from this part of Red River during the year.

The river, from the mouth of the Kiamichi, the upper limit of the improvement, to Fulton, is paralleled by a branch of the Texas and Pacific Railway from Texarkana to Paris, Tex., connecting at the latter place with the St. Louis and San Francisco Railway, a branch of the Atchison, Topeka and Santa Fe system, which crosses Red River at Arthur, Tex. The Kansas City, Pittsburg and Gulf Railroad crosses the river about 10 miles north of Texarkana, and has a branch from Wilton to White Cliffs, Ark., on Little River, a distance of 7 miles, and the St. Louis, Iron Mountain and Southern Railway crosses at Fulton, Ark.

W 3.

IMPROVEMENT OF CYPRESS BAYOU, TEXAS AND LOUISIANA.

The month of July, 1898, passed with no high stage of Red River, and as the gauge records for the preceding twenty-six years, printed in my last report (p. 1592, Report Chief of Engineers for 1898), indicated that there was no probability of a stage sufficient to get the United States dredge at Shreveport, La., across Albany Flats and into the lakes before the following January, Overseer Robert Elflein organized a party at Jefferson, Tex., equipped with tools, tackle, and explosives, to work over the route to Shreveport during the period of low water.

Active operations commenced at Jefferson August 11, 1898, and were carried downstream through Cypress Bayou, Fairy Lake, Sodo Lake, and Twelvemile Bayou, the party reaching Shreveport November 26, 1898.

In Cypress Bayou the overhanging trees were felled and pulled back with lines, to prevent their going into the stream; stumps in the channel were destroyed with explosives, and those along shore that might prove dangerous to passage of boats at high stages were cut close to the ground or removed by blasting. Channel snags and logs were hauled out where the banks were not too steep, and in other cases were blown up with explosives. There being no caving banks along the bayou, systematic clearing, such as has been followed with good results along Red River and other streams of the district, was not necessary, and only overhanging trees were removed. In the dredged cuts a heavy growth of saplings and brush had sprung up since the last work was done, in 1893, which were removed.

The steamboat route was followed down Fairy Lake, and all stumps that could be located were destroyed. Where the water was not too deep, the laborers waded and pulled out all loose logs and stumps. By these means an unobstructed channel to Mooringsport was cleared, in which the depths at the time ranged from 28 inches to 10 feet, and signboards were erected to mark the route worked over. Below Mooringsport to head of Big Pass there was barely 6 inches depth at places. In this stretch all large stumps were blown up, and the smaller ones, averaging about 4 inches in diameter, were chopped close to the water surface, as the depth over them will be ample at any stage, on which boats can cross Sodo Lake. The leaning timber in Big Pass and leaning timber and brush in Little Pass were removed.

Sodo Lake was a big pond of mud, and what little water remained was running in rivulets, the supply having been so scant that the light quarter boat used by the party had to be unloaded and the outfit hauled from Bald Knob to Albany. The bayou which parallels the old channel from Georges Landing to Little Pass has cut into the lake above the former locality, and the water now follows that course, the old channel below Georges Landing to the Gate Posts having been dry at the time this work was done. Through Sodo Lake the stumps in the channel were cut close to the bottom, and the logs were pulled out. While this work was in progress in the upper part of the lake hard rains caused a rise of several inches, the weather turned cold, and the entire force became sick from exposure in working in the mud and water. This prevented thorough work over a short stretch, but when there is a sufficient stage to work the dredge what logs were left can be removed easily.

In Twelvemile Bayou all leaning trees and the timber on caving banks were felled and removed, and the stumps and snags and parts of three old wrecks were destroyed with explosives.

The following is a summary of the work done August 11–November 26, 1898, viz:

Channel snags and logs removed or destroyed	760
Stumps pulled, cut, and destroyed	4,375
Shore snags cut	239
Leaning trees felled	3,323
Trees girdled	139
Square yards of willows and brush cut	50,040
Parts of old wrecks destroyed	3
Towheads removed with explosives	1
Points removed with explosives	2

There was no stage during the fiscal year on which the United States dredge, which has been waiting at Shreveport since July 5, 1897, could cross Albany Flats and enter the lakes. The highest reading of the Shreveport gauge was on January 24, 1899, 15.6 feet.

Money statement.

July 1, 1898, balance unexpended	$11,042.18
June 30, 1899, amount expended during fiscal year	3,577.92
July 1, 1899, balance unexpended	7,464.26
July 1, 1899, outstanding liabilities	11.30
July 1, 1899, balance available	7,452.96

The appropriations for Cypress Bayou and the lakes have been as follows:

By act of—	
June 10 1872	$10,000.00
March 3, 1873	50,000.00
August 14, 1876	13,000.00
June 18, 1878	15,000.00
March 3, 1879	6,000.00
August 5, 1886	18,000.00
August 11, 1888 (allotted from appropriation for Red River)	5,000.00
September 19, 1890, for survey	10,000.00
July 13, 1892, for survey	2,000.00
July 13, 1892 (allotted from appropriation for Red River)	1,701.33
August 18, 1894	10,000.00
June 3, 1896	5,000.00
Total	145,701.33

COMMERCIAL STATISTICS.

There was no navigation between Shreveport and Jefferson during the year.

W 4.

IMPROVEMENT OF OUACHITA AND BLACK RIVERS, ARKANSAS AND LOUISIANA.

GENERAL IMPROVEMENT.

The small balance for general improvement of these rivers was barely sufficient for care of plant until the appropriation for continuing work was made by river and harbor act of March 3, 1899. Immediately after receiving notification of this appropriation preparations were commenced for repairs of the U. S. snag boat *O. G. Wagner*, laid up at Alexandria, La., in order to have that vessel ready for operations during the period of low water. Bids were received and materials ordered for putting on a new roof, repairing woodwork, painting cabin, patching iron decks, etc. All of the supplies required had to be procured at a distance, with the exception of lumber, which had to be sawed, seasoned, and dressed, and the repairs were much delayed by these reasons, but finally were completed June 19.

The *Wagner*, under command of Watkins Decker, master, left Alexandria June 21, entered Black River the following day, and on June 30 had proceeded upstream to Ouachita City, La., near mouth of Bayou Bartholomew, 201 miles above the mouth of Black River. Below Columbia, La., the stages were too high for work, and no obstructions were found. Above that town, however, the water was falling rapidly, and the chief work consisted of removing obstructions in the channel, the following being a summary of what was done, viz:

Snags pulled	26
Stumps pulled and destroyed	11
Stumps cut	4
Leaning trees felled	4

Removed hogchain braces and sides of wreck of steamer *Fanchon* at River Styx, Louisiana.

SURVEY.

Survey work was continued during the year under many difficulties. Asst. Engineer T. C. Thomas, who had been in local charge of this survey, was furloughed July 22, 1898, to enable him to accept a commission as first lieutenant in Third Regiment of U. S. Volunteer Engineers. After getting parties in the field in the autumn, when there was reasonable probability of protracted low stages, yellow fever quarantines delayed or cut off means of communication and of delivering supplies, and protracted rains impeded progress and caused much sickness in the camps, entire parties at times having been disorganized by prevalence of malarial fevers. One man died of hæmaturia, and one had a protracted spell of typhoid fever, and scarcely an employee escaped without sickness more or less severe.

The project for the survey of Ouachita River, with a view to improvement by locks and dams, included surveys of less grade of the principal tributaries, the general idea being that if it should be feasible to give Ouachita River a slack-water navigation the dams might be so placed as to pool the tributaries at the same time, according to their slopes. With this view precise levels had been extended along Bayou Bartholomew and between Bœuf River and Tensas River and Bayou Maçon during progress of the main survey, and it was proposed to run short lines from established benches to most convenient points on the tributaries and establish secondary benches for check points for wye levels; and to make reconnaissances of Bayou Bartholomew, Bœuf River, Tensas River, Bayou Maçon, and Little River, and from data thus acquired to fix approximately the highest point upstream on each to be reached by a maximum pool height from a dam below its mouth. After determining that point, the tributary thence to its mouth was to be surveyed with the same attention as the main stream, and with special care to determine the possible extent of overflow that might be chargeable to a dam. To do the work most expeditiously, sheets on standard scale of 1: 10,000 were prepared for field use from maps of such surveys and examinations as could be found, and from the General Land Office maps. There had been an excess of rain during the summer and a dry autumn was expected, hence it was hoped that by starting the parties by September 15 the surveys of the tributaries named might be finished before the period of high water.

Preliminaries were delayed somewhat by difficulties in procuring and delivering skiffs, shelter tents, etc., and before these details could be completed yellow fever was reported in the northern part of Mississippi. It became necessary to get the parties away from Vicksburg and into Louisiana before travel should be restricted by local or State quarantines, and all previous plans were disarranged. Three parties, however, were made up with employees from the office in charge, as follows: For survey of Bœuf River by Asst. Engineer Walter H. Polk; Tensas River by Surveyor F. Y. Parker; and Bayou Maçon by Surveyor William R. Neely.

The three surveys were begun September 8–11, 1898. That of Bayou Maçon, from Floyd to its mouth, was completed December 15, and that of Tensas River, from Dallas to mouth of Bayou Maçon, was completed December 17. Below the mouth of Bayou Maçon the two parties were united. The survey of Tensas River was continued under local direction of Asst. Engineer G. C. Haydon, and was carried to the mouth January 24, 1899. The survey of Bœuf River extended from Point Jefferson to a point about one-half mile below the mouth of Big Creek. A continued rise set in January 6, 1899, and by January 18 the lands along the lower river were flooded, so that it was impossible to proceed with field work, and after tying in a sufficient number of points to insure recovery the survey was suspended.

Mapping was continued during the year, and after suspension of field work the assistants returned to the office to review, check, index, and tabulate their notes, which has been continued since January.

To complete the survey and make a satisfactory report respecting an improvement by locks and dams the following work is yet required: Completing surveys of the chief tributaries, including a revision of the survey of Bayou D'Arbonne, made in 1883, and a reconnaissance of Saline River, for which appropriations were made in former years; working up the notes and mapping same on scale 1 : 10,000; making a special examination of the large tracts on both sides of Ouachita River known as "The Overflow," to determine limits of overflow during the greatest flood of record (1882). Possible enlargement of reconnaissance of Ouachita River above Camden to Arkadelphia. Careful examination of high-water by-passes, that might cause flanking of a dam and destruction of part of the system. Detailed surveys on large scale of reaches of Ouachita River that are indicated as probable sites for locks and dams from study of the profiles, such as (1) below junction of Ouachita, Tensas, and Little rivers, (2) at or below Catahoula Shoals to pool Ouachita and Bœuf rivers, (3) at about Logtown, (4) at or below Rock Row to pool Ouachita River and Bayou Bartholomew, and (5, 6, 7) at two or three sites between Rock Row and Camden. Discharge measurements.

ESTIMATES.

Quarterboats for chopping parties	$5,000
Outfit, tools, and repairs	2,500
Expenses of snag boats	25,000
Expenses of chopping parties	10,000
Expenses of dredges	5,000
Administration, transportation, gauges, etc	2,500
Total	50,000

Money statement.

July 1, 1898, balance unexpended	$20,748.32
Amount appropriated by river and harbor act approved March 3, 1899	110,000.00
	130,748.32
June 30, 1899, amount expended during fiscal year	24,976.45
July 1, 1899, balance unexpended	105,771.87
July 1, 1899, outstanding liabilities	43.41
July 1, 1899, balance available	105,728.46
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	50,000.00

The amounts expended during the year and balances July 1, 1899, were as follows:

Allotments.	Expended during year.	Balances July 1, 1899.
For general improvement, care of plant, etc	$4,038.55	$36,935.24
For survey	20,937.90	68,836.63
Total	24,976.45	105,771.87

The appropriations have been as follows:

Date of act.	Locality.	Amount.
Mar. 3, 1871	Between Arkadelphia, Ark., and Louisiana State line	$25,000
Do	Between Arkansas State line and Trinity, La	26,000
June 10, 1872	Between Arkadelphia, Ark., and Louisiana State line	60,000
Do	Between Arkansas State line and Trinity, La	40,000
Mar. 3, 1873	....do	60,000
Aug. 14, 1876	Between Camden, Ark., and Trinity, La	12,000
June 18, 1878	....do	10,000
Mar. 3, 1879	....do	10,000
June 14, 1880	....do	8,000
Mar. 3, 1881	....do	12,000
Aug. 2, 1882	....do	12,000
July 5, 1884	Between Camden, Ark., and mouth of Black River, Louisiana	15,000
Aug. 5, 1886	....do	17,500
Aug. 11, 1888	....do	20,000
Sept. 19, 1890	....do	15,000
July 13, 1892	....do	40,000
Aug. 18, 1894	Between Camden, Ark., and mouth of Black River, Louisiana, including survey	50,000
June 3, 1896	Between Camden, Ark., and mouth of Black River, Louisiana, and for completion of survey	70,000
Mar. 3, 1899	....do	110,000
	Total	812,500

COMMERCIAL STATISTICS.

In the fiscal year 1899 Black and Ouachita rivers were reported navigable for regular New Orleans steamboats to Camden, Ark., during the period November 8 to June 15, and to Monroe, La., October 25 to June 30. Small light-draft boats that ply in the tributaries could run in the main river nearly the whole year.

List of steamboats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	Feet.	Feet.	Ft.	In.	Ft.	In.			
America	Stern-wheel.	427	200	39	8	4	0	11	0	New Orleans and Monroe.	21	2,320
City of Camden	do	299.23	175	35	5	2	6	5	6	New Orleans and—		1,953
										Monroe	6	
										Logtown	1	
										Rust Landing	1	
										Columbia	1	
										Danville	2	
										Harrisonburg	2	
										Camden	14	
										Wilmington	1	
										Buffalo Shoals	2	
John Howard	do	447.52	184.6	37.8	6.3	3	0	7	6	New Orleans and—		
										Columbia	1	200
										Monroe	4	
Parlor City	do	136.3	125	26	3.7	2	0	6	0	New Orleans and—		50
										Camden	1	
										Champagnolle	2	
										Columbia	5	
										Monroe and—		
										Waverly	1	
										Morehouse Point	1	
										Lonewa	1	60
										Saline River	1	
										Bayou Bartholomew	5	5
										Bœuf River	10	3
City of Clarksville.	do	235	125	24.5	3.5	2	0	4	0	Monroe and—		
										Champagnolle	20	300
										Bayou Bartholomew	16	
										Bœuf River	2	
C. B. Bryan	do	330.44	114.2	29	4.5	2	0	4	0	Monroe and—		
										New Orleans	1	
										Jonesville and Tensas River.	4	
T. K. Green	do	32.77	81.8	17.3	3.1	1	6	3	0	Knights Landing and Bœuf River.	18	
J. W. Swayze	do	86.62	110	21	3.7	1	8	4	0	Jonesville, Tensas River, and Bayou Maçon.	83	
Lillie *a*	do	61	120	26	3.5	2	0	4	0	do	3	
C. A. Hill	do	69	119.5	21.3	3.6	2	0	3	6	Trinity, Tensas River, and Bayou Maçon.	26	50
Victor *a*	do	138.67	138.5	26	4.6	...		...		New Orleans and Camden.	2	
Rosa B. *b*	do	41.85	82.6	15.8	3	1	5	2	6	Monroe and—		20
										Columbia	1	
										Lonewa	2	
										Lake Landing	2	
										Pargoud	1	
										Wellington	1	
										Bayou D'Arbonne	25	40
										Saline River	1	.....
										Bayou Bartholomew	21	10
Belle Prince *a*	do	109.12	114.4	19.6	3.6	7	0	8	0	New Orleans and—		
										Camden	2	.....
										Warren	3	.....
Will Davis *a*	do	150	100.8	23.6	3.6	1	8	2	2	New Orleans and—		
										Moro Bay	1	.....
										Camden	2	.....
Ramos *a*	do	37.61	60.2	11.5	6	...		...		New Orleans and Jonesville.	1	.....
T. A. Hendricks *a*	do	81.86	108	22.5	4.2	4	0	4	1	New Orleans and Camden.	1	.....
Alarm *a*	do	189.09	142	26	4.3	3	5	4	5	New Orleans and Upper Ouachita River.	1	.....

a Towboats. *b* With one or more barges.

List of steamboats engaged in the trade during the fiscal year—Continued.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Resolute *a*	Stern-wheel.	207.78	139.6	29	3.9	3	0	4	3	New Orleans and Camden.	1	.....
Bettie Lee *b*	...do	28	56	12	2.5	1	0	2	6	Monroe and Jonesville Jonesville, Tensas River, and Bayou Maçon.	1 1	....
Dewey	...do	665.93	240	66	5.8	4	0	9	0	New Orleans and Monroe.	3	20
Freddie Wall *b*	...do	......	......	......	......	1	0	2	0	Monroe and Bayou D'Arbonne.	40	.....
Stoneware *a*	...do	104.45	100	17	3	2	2	3	6	New Orleans and Bœuf River.	1	.....
May Fisher *a*	...do	52.84	92	18.8	4	2	0	2	0	Baton Rouge, Tensas River, and Bayou Maçon.	6	.....
John B. Robinson. *b*	...do	12	65	12	2.5	1	0	2	6	Monroe and Bayou Maçon. Monroe and Bayou D'Arbonne.	1 100	....
Shiloh *b*	...do	14	64	14	2.6	......		......		.....do	52	.....
Zola Davis	...do	......	......	......	......	......		......		No report.		
Teal *b*	Tug	48.28	85	19.6	4	3	0	5	0	Jonesville and Tooley's	313	500
Louisa *b*	...do	4	......	......	......	4	0	4	0	Stafford and Bœuf River.	40	.....
Dixie *b*	...do	16.94	52.6	12	4	4	0	4	6	New Orleans and Ouachita River. (In river entire season making up stave tows.)	1	.....
Manhattan *b*	...do	......	......	......	......	......		......		Jonesville, Tensas River, and Bayou Maçon.	10	.....
Lee Otis	...do	4.5	40	9	5	4	6	4	6	No report.		
Alice G	...do	......	......	......	......	......		......		No report.		
Grover K	...do	......	......	......	......	......		......		Stafford and Bœuf River.	104	.....
Oceola	Stern-wheel.	24.39	70.6	15.2	2.9	1	0	2	6	No report.		
Wayzata	Launch	6	33	7	3.7	1	9	2	2	Local towing for sawmills at Monroe.	.....	.....
Skipper	...do	......	......	......	......	......		......		.....do	.....	.....

a Towboats. *b* With one or more barges.

The steamer *John Howard* burned at Columbia, La., December 11, 1898.

Summary of commerce reported.

Articles.	1898–99.	1897–98.	1896–97.	1895–96.	1894–95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	18,343	19,813	12,959	9,599	21,070
Cotton seed	8,037	15,734	22,657	4,706	6,005
Hides and skins	13	44	16	68	166
Live stock	382	574	561	254	329
Lumber	1,784	1,063	2,302	1,080	218
Saw logs	39,316	31,244	51,066	49,000	10,000
Staves	111,831	97,614	119,059	26,332	18,891
Miscellaneous	8,402	8,445	3,540	7,112	5,660
Total down freight	188,108	174,531	212,160	98,151	62,339
Return freight	11,576	23,143	17,390	19,866	11,340
Total	199,684	197,674	229,550	118,017	73,679
Estimated value	$6,121,000	$5,084,000	$5,722,000	$5,123,000	$3,293,000

Summary of commerce reported—Continued.

Articles.	1893-94.	1892-93.	1891-92.	1890-91.	1889-90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	11,176	11,383	21,890	21,433	16,652
Cotton seed	3,645	4,423	5,577	6,593	5,058
Hides and skins	72	4	7	25	36
Live stock	549	845	89	172	62
Lumber	262	18,000	461	16,388	7,951
Saw logs	28,257	28,000	26,880	120,000	50,000
Staves	31,519	9,378	23,402	17,888	21,159
Miscellaneous	6,572	5,251	5,197	28,856	783
Total down freight	82,052	77,284	83,503	211,355	101,701
Return freight	13,808	11,157	18,317	27,842	40,766
Total	95,860	88,441	101,820	239,197	142,467
Estimated value	$3,430,000	$4,466.000	$6,680,600	$9,130,000	$10,234,250

Receipts and shipments of bales of cotton at Monroe, La.

Route.	1898-99.		1897-98.		1896-97.	
	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.
Vicksburg, Shreveport and Pacific R. R.	7,447	20,223	17,273	25,473	11,406	19,661
Missouri Pacific Rwy	21,016	26,278	29,918	37,259	21,421	28,381
River	15,686	9,556	7,148	9,278	1,579	3,133
Wagon	17,078	....	17,478	....	17,087	....
Total	61,227	56,057	71,817	72,010	51,493	51,175

Route.	1895-96.		1894-95.	
	Received.	Shipped.	Received.	Shipped.
Vicksburg, Shreveport and Pacific R. R.	17,418	27,077	16,514	31,389
Missouri Pacific Rwy	14,731	19,975	22,383	32,271
River	3,770	6,267	4,698	5,204
Wagon	17,872	....	25,358	....
Total	53,791	53,319	68,953	68,864

Receipts and shipments of bales of cotton at Camden, Ark.

Route.	1898-99.		1897-98.		1896-97.	
	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.
Missouri Pacific Rwy	3,884	13,175	4,882	9,860	1,342	5,381
St. Louis Southwestern Rwy	3,510	10,177	2,180	8,796	3,896	6,902
River	....	6,923	517	7,868	918	5,963
Wagon	23,000	....	21,197	....	13,822	....
Total	30,394	30,275	28,276	26,524	19,978	18,246

The following information was furnished by the Camden Commercial League as showing the resources of the country whose commerce and freight rates are affected by navigation of Ouachita River:

	1898-99.	1897-98.	1896-97.	1895-96.
Population of territory affected	683, 498	634, 332	608, 983	564, 518
Annual cotton crop (estimated) ....bales..	931, 809	893, 438	878, 578	813, 498
Estimated value	$37, 272, 360	$35, 737, 520	$34, 150, 230	$32, 539, 920
Present freight rate per bale to eastern seaboard	$3. 50	$3. 50	$3. 50	$3. 50
Freight saving on cotton, if water route were available	$1, 863, 618	$1, 665, 650	$1, 640, 000	$1, 550, 000
Annual crop of cotton seed (estimated) . tons..	460, 000	430, 000	420, 000	385, 000
Estimated value	$5, 104, 000	$4, 100, 000	$4, 000, 000	$4, 000, 000
Freight saving on cotton seed, if water route were available	$1, 400, 000	$1, 250, 000	$1, 235, 000	$1, 145, 000
Lumber marketed ...tons..	7, 368, 549	6, 348, 915	5, 228, 318	4, 835, 000
Value of lumber shipped	$165, 968, 000	$101, 600, 000	$91, 896, 080	$82, 700, 000
Taxable property in district	$93, 987, 000	$91, 618, 000	$87, 538, 000	$84, 635, 000
Amount of freight paid all lines of transportation	$27, 634, 000	$23, 985, 000	$18, 785, 000	$17, 815, 000
Amount of business transacted	$276, 758, 000	$236, 875, 000	$212, 958, 000	$197, 895, 000

The competing lines of transportation are as follows: Ouachita River is crossed by the St. Louis, Iron Mountain and Southern Railway at Arkadelphia, Ark.; by the St. Louis Southwestern Railway (Cotton Belt Route) at Camden, Ark., and by the Vicksburg, Shreveport and Pacific Railroad at Monroe, La. The St. Louis, Iron Mountain and Southern Railway has a branch line parallel to the river from Eldorado to Gurdon, Ark., and thence by the main line to Arkadelphia. A projected extension of this branch will give direct communication with the Mississippi River at Arkansas City, Ark., the part to be built being from Camden to Warren, Ark., a distance of about 50 miles. The Houston, Central Arkansas and Northern Railroad (another branch of the Missouri Pacific system) connects with Arkansas City at McGehee, 12 miles west, and thence runs in a southwesterly direction about midway between Bayou Bartholomew and Bœuf River, touches the Ouachita River, and crosses the Vicksburg, Shreveport and Pacific Railroad at Monroe, La., and continues down, parallel to the main river, to Columbia, La., crossing at Riverton, 4 miles above Columbia, and runs thence to Alexandria, La. The Natchez, Red River and Texas Railroad (narrow gauge) runs from Black River Station, opposite Trinity, to Vidalia, La., on Mississippi River opposite Natchez, Miss. The New Orleans and Northwestern Railway is completed from Natchez, Miss., to Bastrop, La., and crosses Tensas River near its mouth and Bœuf River about 2 miles north of Rayville, La. The extension of the Kansas City, Watkins and Gulf Railway from Alexandria, La., to Natchez, Miss., has been begun, and will cross Black River about 7 miles below Trinity, La. The Mississippi River, Hamburg and Western Railway, a lumber road, has been constructed from Sunnyside on Mississippi River to Hamburg, Ark., crossing Bayou Bartholomew near Portland, and probably will be extended westward.

W 5.

IMPROVEMENT OF BAYOU BARTHOLOMEW, LOUISIANA AND ARKANSAS.

Preparatory to resuming work for maintenance of this improvement, under appropriation of $5,000 made by river and harbor act approved March 3, 1899, a quarter-boat was towed up Ouachita River 127 miles, from Trinity to Monroe, La., April 10 to 12. At Monroe the outfit belonging to Ouachita River survey and unserviceable public property which crowded the boat were transferred to a warehouse for storage; subsistence supplies, explosives, etc., were taken aboard, and April 25 to May 9 the quarter-boat was towed from Monroe to Portland, Ark., near the head of navigation on Bayou Bartholomew.

The work was placed in local charge of Mr. James R. Vaughan, an overseer with long experience in the class of operations required, and the following obstructions to navigation were destroyed on the way up the bayou, viz:

Logs in channel	2
Jams of drift	7
Leaning trees	12

Since the boat reached Portland, frequent rains near the head waters of Bayou Bartholomew have kept the stream at stages too high for effective work, and the organization of a force of laborers has been deferred on that account. The quarter-boat was painted inside and out, such minor repairs as were needed were made, and the tools were sharpened ready for use, etc. The stage was falling the latter part of June, and the indications were that operations at McComb Landing, above Portland, might begin before July 10.

The annual cost of maintaining the work in Bayou Bartholomew was estimated to be $2,500. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add new obstructions, which, if allowed to remain, accumulate more rapidly and become more difficult to remove each year.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$5,000.00
June 30, 1899, amount expended during fiscal year	965.70
July 1, 1899, balance unexpended	4,034.30
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,500.00

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1881	$8,000	July 13, 1892	$5,000
August 2, 1882	5,000	August 18, 1894	5,000
July 5, 1884	5,000	June 3, 1896	4,000
August 5, 1886	5,000	March 3, 1899	5,000
August 11, 1888	5,000		
September 19, 1890	5,000	Total	52,000

COMMERCIAL STATISTICS.

Bayou Bartholomew was reported navigable from November 1, 1898, to June 30, 1899.

List of stern-wheel steamboats engaged in navigation during year.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft. Light.		Draft. Loaded.		Between—	Round trips.	Passengers.
		Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
City of Clarksville	235	125	21.5	3.5	2	0	4	0	Monroe and the State line	16	....
Parlor City	136.3	125	26	3.7	2	0	6	0	Monroe and—		5
									Dades	1	
									Gordons	2	
									Grants	1	
									Elders	1	
Rosa B	41.85	82.6	15.8	3	1	5	2	6	Monroe and—		10
									The State line	4	
									Grants	1	
									Hopkins	1	
									Lind Grove	6	
									Modoc	2	
									Marbles	1	
									Hope	1	
									Phipps	1	
									Knox	4	
Irwin (tug)	8	35	8	......	2	6	3	2	Monroe and Portland, Ark	1	....

Summary of commerce reported.

Articles.	1898-99.	1897-98.	1896-97.	1895-96.	1894-95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	2,125	1,206	175	1,235	1,390
Cotton seed	6,750	2,950	9,040	270	3,826
Saw logs	1,300	1,000	2,020	7,683	....
Staves	693	832	2,165	6,012	117
Miscellaneous	480	900	224	350	100
Total down freight	11,348	6,888	13,624	15,550	5,433
Return freight	1,315	1,188	615	2,110	1,200
Total	12,663	8,076	14,239	17,660	6,633
Estimated value	$382,000	$284,000	$97,000	$561,000	$243,000

Articles.	1893-94.	1892-93.	1891-92.	1890-91.	1889-90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	2,434	1,000	2,372	3,971	2,000
Cotton seed	2,991	1,800	3,326	2,467	4,000
Cotton-seed meal	....	....	1,425	516	....
Saw logs	159	2,000	4,450	20,080	11,839
Staves	2,569	2,375	1,648	17,822	....
Miscellaneous	665	175	410	1,340	....
Total down freight	8,818	6,850	13,631	46,196	17,839
Return freight	3,469	825	1,534	3,103	4,000
Total	12,287	7,675	15,165	49,299	21,839
Estimated value	$564,000	$136,000	$515,000	$826,000	$492,700

This stream is crossed at Baxter, Ark., the upper limit of improvement, by a branch of the St. Louis, Iron Mountain and Southern Railroad, which connects with the Mississippi River at Arkansas City, Ark., runs west 56 miles to Warren, Ark., and probably will be extended to Camden, on the Ouachita, which is connected with the main line by a branch to Gurdon, Ark. The Houston, Central Arkansas and Northern Railroad (another branch of the Missouri Pacific system) runs parallel to Bartholomew from McGehee, Ark., to Monroe, La. The New Orleans and Northwestern Railway, completed to Bastrop, La., crosses the Houston, Central Arkansas and Northern Railroad at Collinston, 7 miles south of Bastrop. A new line from Sunnyside Landing, Ark., on the Mississippi River, to Hamburg, Ark., crossing Bayou Bartholomew near Portland, Ark., has been built.

W 6.

IMPROVEMENT OF BŒUF RIVER, LOUISIANA.

After suspension of operations in Bayou Maçon, Louisiana, the party which had been employed in that stream was transferred to this improvement. The quarter boat was dropped downstream from mouth of Bayou Maçon to Trinity, La., at the junction of Tensas, Ouachita, and Little rivers, where supplies were taken aboard.

October 2, 1898, the quarter boat was towed up Ouachita River to mouth of Bœuf River, and from October 3 to December 23, 1898, operations were carried upstream to Point Jefferson. The work was done under local direction of Overseer J. R. Vaughan, and consisted of cutting leaning timber, logs, stumps, channel and shore snags and brush, and destroying the heavier obstructions to navigation with explosives. When work commenced, there was a stage of about 3 feet above low water, but from mouth of Bœuf River to mouth of Bayou Lafourche, estimated to be about 55 miles, the stream was comparatively free of obstructions. Above the Lafourche to Point Jefferson, however, more or less obstructions were met with, caused by fallen trees deadened in former years, and by the carelessness of timbermen who had felled large trees into the stream, and who took no measures for removing tree tops from the channel when trimming up their logs.

The following is a summary of the work done, viz:

Distance in miles worked over (estimated)	133
Channel snags cut and destroyed	921
Shore snags cut and destroyed	366
Logs cut and destroyed	1,675
Stumps cut and destroyed	501
Side jams removed	6
Leaning trees cut and destroyed	1,156
Square yards of willows and brush cut	21,996

This work was carried on at a period when lowest stages were to be expected, there seldom being a rise of any consequence before the latter part of December; but operations were much impeded by frequent heavy rains and by the oscillations of the river which they caused, work having been entirely suspended from November 18 to 30 by a high stage. Some obstructions in the channel could not be located on this account, and there has been an extraordinarily rapid growth of willows and brush along the banks and on the bars, all of which could not be cut. For these reasons it is desirable to resume work at the first low stage, and it is expected to transfer the force employed in Bayou Bartholomew to this stream as soon as practicable.

Attention is respectfully invited to the correspondence relating to the closure of the three outlets of Bœuf River, near Point Jefferson, La., published in Report of the Chief of Engineers for 1897, page 1917, and to additional letters upon the subject, viz:

United States Engineer Office,
Vicksburg, Miss., March 14, 1899.

General: Complying with instructions contained in your letter of 10th instant, I have the honor to submit the following recommendation respecting the expenditure of the appropriation made by river and harbor act of March 3, 1899, for "Improving Bœuf River, Louisiana: Continuing improvement, $6,000."

The project for this work, adopted in 1881, contemplated removing snags, logs, leaning limber, etc., to afford safe navigation at high stages from the mouth to Wallace Landing, about 152 miles above, and was completed in 1896. The latter year a recommendation for maintenance at an annual cost of about $2,500 was approved, new obstructions being constantly added by drift, sliding and caving banks, and the rapid growth of timber and brush along the shores. The closure of three outlets near Point Jefferson to confine the flow to the main channel was added to the project in 1886. These outlets were closed as securely as possible with the funds available in 1887–88, and the work gave immediate benefit to navigation by confining the river to its channel and scouring the bars below. The dams closing the outlets were destroyed in 1890 during an overflow from Mississippi River, caused by breaks in levees along the Arkansas front near the head waters of Bœuf River, and funds sufficient for their restoration have not been provided.

The river and harbor act of June 3, 1896, appropriated $6,000 for continuing improvement of Bœuf River, Louisiana, and no portion of that amount has been drawn from the Treasury, the project for its expenditure having been held in abeyance in accordance with my recommendation of June 23, 1896, approved by the Acting Chief of Engineers July 3, 1896, the reasons being as follows:

"All the outlets should be closed and connected by a levee at least 3 feet above highest water. The cost of the work was given in my report of 1893 at $30,000, with the recommendation that nothing be done until a specific appropriation was made for the purpose, which has been repeated each year since. The outlets are a serious injury to navigation of the river. * * * The funds available are not sufficient to close the three outlets, and it will be unwise to commence work until all can be closed without delay. To close any one of them alone would waste the money and invite disaster. No help can be expected from the State, the parish, or individuals."

The conditions are practically the same to-day, and it would be a waste of money to attempt to do the work required for the closure of these outlets with the funds available, or, in other words, to try to do $30,000 worth of work with 40 per cent of that sum.

The estimates for the fiscal year 1900, as given in my last report (Report Chief of Engineers, 1898, p. 1615), were: "For closing outlets (in addition to $6,000 available), $24,000; for maintenance, $2,500." I recommend, therefore, that the sum of $2,500 from the appropriation by act of June 3, 1896, be allotted for maintenance of the work done since 1881, and that for the present no provision be made for the expenditure of the balance of that appropriation and all of the appropriation of 1899, a total of $9,500.

It is proposed to use the $2,500 for operations of a party equipped with tools, tackle, and explosives to work over the river between the mouth and Point Jefferson and remove snags, logs, leaning timber, etc., obstructing navigation, added since the last work was done. This can be done with greatest economy and advantage to the United States by hired labor, the employees necessarily being furnished with subsistence and shelter.

Very respectfully, your obedient servant,

J. H. WILLARD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

OFFICE OF THE CHIEF OF ENGINEERS,
U. S. ARMY,
Washington, March 29, 1899.

MAJOR: Your letter of the 14th instant, submitting recommendation regarding expenditure of the available balance, including the appropriation of $6,000 made by the river and harbor act of March 3, 1899, for improving Bœuf River, Louisiana, was duly received and submitted to the Secretary of War by indorsement of the Chief of Engineers, dated March 23, 1899, as follows:

[Second indorsement.]

OFFICE OF CHIEF OF ENGINEERS,
U. S. ARMY,
March 23, 1899.

Respectfully submitted to the Secretary of War.

The river and harbor act of June 3, 1896, contained an appropriation of $6,000 for improving Bœuf River, Louisiana, but for engineering reasons the consideration of a project for the expenditure of this sum was held in abeyance and no part of the money has been drawn from the Treasury.

The sum of $6,000 is appropriated for this improvement by the river and harbor act of March 3, 1899, making a total of $12,000 now available.

Major Willard, the local officer, for reasons given within, states that the amount available is not sufficient to complete work required for the closing of outlets for the purpose of confining the river to its channel and he recommends that the sum of $2,500 from the appropriation of June 3, 1896, be allotted for maintenance of work done since 1881, and that for the present no provision be made for further expenditure of the balance available for this work.

I concur in his views.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

The paper has been returned to this office by War Department indorsement of March 27, 1899, "Approved as recommended by the Chief of Engineers."

By command of Brig. Gen. Wilson:

Very respectfully, your obedient servant,

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

Maj. J. H. WILLARD,
Corps of Engineers.

(Through the Division Engineer.)

Money statement.

July 1, 1898, balance unexpended		$8, 058. 46
Amount appropriated by river and harbor act approved March 3, 1899		6, 000. 00
		14, 058. 46
June 30, 1899, amount expended during fiscal year		1, 995. 37
July 1, 1899, balance unexpended		12, 063. 09
Amount (estimated) required for completion of existing project		20, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901:		
For works of improvement	$20, 500. 00	
For maintenance of improvement	2, 500. 00	
		23, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

The following appropriations have been made:

By act of—		By act of—	
March 3, 1881	$5, 000	July 13, 1892	$10, 000
August 2, 1882	5, 000	August 18, 1894	8, 000
July 5, 1884	5, 000	June 3, 1896	6, 000
August 5, 1886	5, 000	March 3, 1899	6, 000
August 11, 1888	6, 000		
September 19, 1890	5, 000	Total	61, 000

COMMERCIAL STATISTICS.

Bœuf River was reported navigable from October 1, 1898, to June 2, 1899.

List of steamboats engaged in navigation in the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between.	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Parlor City	Stern-wheel.	136. 30	125	26	3. 7	2	0	6	0	Monroe and— Purvis Railroad bridge Mrs. Jordan's	 6 2 2	 .... 3 ....
T. K. Green [a]	...do	32. 77	81. 8	17. 3	3. 1	1	6	3	0	Knight Landing and Alto.	18	....
C. A. Hill [a]	...do	69. 62	119. 5	21. 3	3. 6	2	6	3	0	New Orleans and Bœuf River.	1	....
Stoneware [b]	...do	104. 45	100	17	3	2	2	3	6	.....do	1	....
City of Clarksville.	...do	235	125	24. 5	3. 5	2	0	4	0	Monroe and Bœuf River.	2	....
Louisa [a]	Tug	4	......	......	......	4	0	4	0	Stafford and various landings.	40	....
Grover K [a]	...do	....	....	....	....	....	....	....	....	.....do	104	....
Lee Otis [a]	...do	4. 5	40	9	5	4	6	4	6	No report	....	....

[a] With one or more barges.

[b] Towboat.

Summary of commerce reported.

Articles.	1898–99.	1897–98.	1896–97.	1895–96.	1894–95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	1,555	375	130	707	876
Cotton seed	1,465	1,860	188	1,633	2,313
Hides and skins	1	2	1	8	1
Live stock	6	21	....	64	76
Lumber	20	870	23	1,100	75
Saw logs	....	20	....	840	....
Staves	3,296	1,660	10,675	4,000	1,389
Miscellaneous	100	200	20	190	136
Total down freight	6,443	5,088	11,037	8,542	4,866
Return freight	320	211	224	425	250
Total	6,763	5,219	11,261	8,967	5,116
Estimated value	$291,000	$130,000	$69,000	$270,000	$159,000

Articles.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	900	626	1,583	1,760	1,397
Cotton seed	2,550	1,878	1,178	716	731
Hides and skins	....	....	50	....	....
Live stock	12	....	19	....	....
Lumber	300	250	1,352	....	....
Saw logs	....	....	1,223	....	....
Staves	4,626	923	3,138	1,777	263
Miscellaneous	450	300	72	179	....
Total down freight	8,838	3,977	8,615	4,432	2,391
Return freight	650	335	1,370	3,458	1,594
Total	9,488	4,312	9,985	7,890	3,985
Estimated value	$350,000	$200,000	$501,000	$636,500	$580,850

The Vicksburg, Shreveport and Pacific Railroad crosses Bœuf River near Girard, La., and the New Orleans and Northwestern Railway crosses about 2 miles north of Rayville, La. The Houston, Central Arkansas and Northern Railroad runs parallel to the river on the west, and a line is projected (Louisiana, Arkansas and Missouri Railroad) which will touch the river at several points on the east.

W 7.

IMPROVEMENT OF TENSAS RIVER AND BAYOU MAÇON, LOUISIANA.

No work was done during the year for the improvement of Tensas River.

The work begun at Floyd, La., on Bayou Maçon, June 27, 1898, was continued downstream from the Motley Place, 5 miles below Floyd, to Tensas River, July 1 to September 27, 1898. Operations were carried on during the period of lowest water, under the supervision of Overseer J. R. Vaughan, by a party equipped with tools, explosives, tackle, etc., a light quarter boat having been used for shelter of employees at night, and for storage of supplies and of outfit when not in use.

The work consisted of cutting overhanging trees, stumps, brush, and shore snags along the banks, and trees, snags, logs, and stumps in the channel. Such obstructions to navigation as could not be removed in that manner were sawed up and hauled out with blocks and tackle, or were destroyed with high explosives, which were used freely for removing heavy snags and stumps.

The following is a summary of the work done, viz:

Distance, in miles, worked over (estimated)	93
Channel snags cut and destroyed	1,746
Shore snags cut and destroyed	879
Logs removed from channel	1,063
Logs cut and destroyed	2,686
Stumps cut and destroyed	1,571
Side jams removed	7
Leaning trees cut and destroyed	1,425
Square yards of willows and brush cut	34,974

This work put Bayou Maçon in good condition for navigation and completed the project of 1884 for removal of snags, logs, etc., to afford safe navigation at medium and high stages from Tensas River to Floyd. It will not be permanent, as new obstructions are added each year.

After suspension of work in Bayou Maçon, the party, quarter boat, and outfit of tools, etc., were transferred to the improvement of Bœuf River.

Operations under the act of March 3, 1899, in Tensas River and Bayou Maçon are to be resumed as soon as practicable, it being the intention to employ one skilled party, under supervision of an efficient overseer, in the various tributaries of Ouachita River, transferring work from one to another as funds run out, or as stages may render advisable.

The approved plan for work in these streams, submitted December 1, 1880 (Report Chief of Engineers, 1881, pp. 1457 and 1462), contemplated thorough work in one low-water season, which it was estimated would cost $40,000, for the purpose of removing snags, logs, leaning timber obstructing navigation at stages when steamboats could run; in Tensas River from its mouth to Dallas, La, about 134 miles, and in Bayou Maçon, the chief commercial branch, from its entrance into Tensas River to Floyd, La., about 98 miles.

The first appropriation was made by river and harbor act of March 3, 1881, and the total sum appropriated to the present time is $40,000, the amount estimated for a single season having been made to answer for twenty years' work. Under these conditions it could scarcely be expected that the project would be carried out as planned originally. It may be stated, however, that Bayou Maçon is in fairly good navigable condition for the time, from its mouth to Floyd. Tensas River also is in good navigable condition below the mouth of the Maçon, and is fairly unobstructed above the Maçon to Westwood Place, about 75 miles from its entrance into Ouachita River at head of Black River. Upper Tensas River, from a short distance above Westwood Place to Dallas, practically is unnavigable, and it seems useless to clear it of obstructions, as there is no demand now for navigation of that part of the river. The once productive plantations along its banks were abandoned more than thirty years ago, on account of successive overflows from Mississippi River, have not been reclaimed to any extent, and are now the haunt of wild game.

To maintain what has been accomplished since 1881 for the improvement of Tensas River and Bayou Maçon will require an annual expenditure of $2,500 for some years to come for the removal of obstructions added from time to time and to prevent a return of the former obstructed condition of those streams.

Money statement.

July 1, 1898, balance unexpended	$2,865.04
Amount appropriated by river and harbor act approved March 3, 1899	4,000.00
	6,865.04
June 30, 1899, amount expended during fiscal year	2,727.48
July 1, 1899, balance unexpended	4,137.56
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1881	$3,000	August 18, 1894	$5,000
July 5, 1884	4,000	June 3, 1896	5,000
August 5, 1886	4,000	March 3, 1899	4,000
August 11, 1888	5,000		
September 19, 1890	5,000	Total	40,000
July 13, 1892	5,000		

COMMERCIAL STATISTICS.

During the fiscal year Tensas River was reported navigable from October 15 to June 15, and Bayou Maçon for about the same period.

List of steamboats reported navigating Tensas River and Bayou Maçon in the fiscal year 1899.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	Feet.	Feet.	Ft.	In.	Ft.	In.			
Bettie Lee	Stern-wheel.	28	56	12	2.5	1	0	2	6	Crocketts Point and Floyd, Bayou Maçon.	63	....
Lillie	do	61	120	26	3.5	2	0	4	0	Jonesville and landings on Bayou Maçon.	3	....
C. A. Hill	do	69	119.5	21.3	3.6	2	0	3	6	Trinity and New Light on Tensas River and Crocketts Point on Bayou Maçon.	26	59
J. W. Swayze	do	86.62	110	21	3.7	1	8	4	0	Jonesville and Jordans on Tensas River and Crocketts Point on Bayou Maçon.	83	....
May Fisher *a*	do	52.84	92	18.8	4	2	0	2	0	Baton Rouge, Tensas River, and Bayou Maçon.	6	....
C. B. Bryan	do	330.44	114.2	29	4.5	2	0	4	2	Jonesville and landings on Tensas River and Bayou Maçon.	4	....
Stoneware *b*	do	104.45	100	17	3	2	2	3	6	New Orleans, Tensas River, and Bayou Maçon.	1	....
John B. Robinson.	do	12	65	12	2.5	1	0	2	6	Monroe and Upper Bayou Maçon.	1	....
Oceola	do	24.39	70.6	15.2	2.9	1	0	2	6	No report	....	....
Dixie *a*	Tug	16.94	52.6	12	4	4	0	4	6	New Orleans, Tensas River, and Bayou Maçon.	1	....
Manhattan	do	......	......	......	......	......		......		Jonesville, Tensas River, and Bayou Maçon,	10	....
Lee Otis	do	4.5	40	9	5	4	6	4	6	No report	....	....
Alice G	do	......	......	......	......	......		......		do	....	....

a With one or more barges. *b* Towboat.

Summary of commerce reported.

Articles.	1898–99.	1897–98.	1896–97.	1895–96.	1894–95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons,*
Cotton	4,734	3,635	1,310	1,038	1,543
Cotton seed	7,718	13,048	3,544	2,444	2,993
Hides and skins	52	....	2	....	50
Live stock	....	....	200	....	290
Staves	7,255	2,934	10,321	285	260
Lumber	567	1,060	400	640	4,012
Miscellaneous	663	465	100	150	1,045
Saw logs	919	575	5,000	....	....
Total down freight	21,908	21,717	20,877	4,557	10,193
Return freight	1,697	1,022	1,419	272	2,092
Total	23,605	22,739	22,296	4,829	12,285
Estimated value	$774,000	$600,000	$535,000	$146,000	$561,000

Articles.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	450	498	3,762	2,760	1,527
Cotton seed	1,400	1,457	4,876	4,850	2,920
Hides and skins	2	3	....	10	2
Live stock	108	3	10	6	....
Staves	895	26	71	1,032	3,325
Lumber	300	....	440	....	....
Miscellaneous	104	....	1,942	378	50
Saw logs	....	....	....	....	....
Total down freight	3,259	1,987	11,101	9,036	7,824
Return freight	2,700	662	5,886	6,000	5,216
Total	5,959	2,649	16,987	15,036	13,040
Estimated value	$389,000	$122,500	$990,000	$999,500	$742,390

The Vicksburg, Shreveport and Pacific Railroad crosses Bayou Maçon near Delhi, La. The New Orleans and Northwestern Railroad crosses Tensas River at Clayton, Concordia Parish, La.

W 8.

IMPROVEMENT OF YAZOO RIVER, MISSISSIPPI.

As stated in my last report, the U. S. snag boat *John R. Meigs*, in command of P. R. Starr, master, was transferred April 27, 1898, under authority of the Chief of Engineers, to Major James B. Quinn, Corps of Engineers, for temporary service upon the defensive works at the entrance to Mississippi River, as a war emergency. The boat was employed in placing and raising torpedoes in Mississippi River near Forts Jackson and St. Philip, La., from May 4 to September 3, 1898, under the immediate direction of Lieut. Henry Jervey, Corps of Engineers. On the latter date, while engaged in taking up one of the torpedoes, an explosion occurred wrecking the bow of the *Meigs* and killing Capt. Starr and four others. Under the influence of the tide and wind the snag boat drifted to the Fort St. Philip shore, where it sank in deep water. The destruction of the *Meigs* and the death of its efficient master were a great loss to the district, especially to Yazoo River and tributaries, where the boat had performed the principal work done since its construction in 1879.

Captain Starr has been in command of the snag boat since August, 1884, and by his death I lost a zealous assistant, faithful in the discharge of every duty intrusted to him.

Operations for the improvement of navigation of Yazoo River were carried on during the period of low water by a force of laborers, equipped with tools, explosives, tackle, etc., working under the supervision of Overseer John Schuh, and extended from the head of Honey Island to the mouth of Little Sunflower River.

By courtesy of the officers of the Yazoo City Transportation Company, the steamer *Ashland City*, belonging to that line, towed the U. S. quarter boat from Yazoo City to Burtonia on the river side of Honey Island, without charge for the service, where operations commenced July 4, 1898. From that date to September 5, 1898, work was carried downstream to Clark's Ferry, 8 miles above Yazoo City. Frequent rains and local rises during that period prevented thorough work at various localities, for removal of snags in the channel which obstructed navigation at the lowest stages, and September 5–6 the quarter boat was towed back to Burtonia to work over the stretch between that place and Yazoo City, which was done September 7–30.

The river west of Honey Island, from Burtonia to mouth of Tchula Lake, is narrow and crooked, and shore snags, and stumps and snags, brought into the channel by sliding and caving banks, were numerous. In the short bends large trees, extending nearly across the river, were found embedded in the bottom. These obstructions were sawed and chopped up and pulled out, so far as practicable, but the heavier ones were destroyed with explosives, notable improvement having been reported at the following places, viz: From Burtonia to Gun Bayou, Castleman's Reach, above mouth of Little Atchafalaya, Wood Reach, Dewdrop, from Bermuda to Hendrick's gin, and near Roseneath, all on the river side of Honey Island. Also at the following places below mouth of Tchula Lake, viz: Lodi, Pluto, Warmacks, Parker Bayou, Belle Prairie, Piney Creek, McGould, bend above Elm Grove, and opposite Yazoo City, where bank was caving.

October 1–November 8 work was continued below Yazoo City to mouth of Big Sunflower River. In that stretch the channel was much obstructed by snags, stumps, and trees that had caved or slid into the river. These obstructions were hauled out on the banks and cut up, or were destroyed with high explosives. At Short Creek a crib of timber, containing 23 logs, had lodged in the channel, but was released, pulled to the bank, made fast, and the snags upon which it had caught were destroyed. A brush wing dam was built from the west bank at that place to contract the channel, and since its construction steamboats have had no difficulty in passing the shallow stretch. Side jams were removed at Bridgeway and Eagle Bend, and at Sycamore Mound part of an old wreck, which was creating a bar formation and causing the opposite bank to cave, was destroyed; its removal having restored the channel to its former straight course. During this period work was impeded by bad weather and by much sickness among the men, and as yellow fever was in Yazoo City, a few miles away, it was impracticable to increase the force, and difficult to procure supplies required from time to time.

November 9–10 the quarter boat was towed to the wreck of the steamer *Fifteen* (sunk October 30, 1897) at head of Honey Island. Work of removing the wreck was commenced November 11 and completed November 13. The machinery was removed as far as practicable and placed upon the bar below, after which the hull was destroyed with explosives.

November 14–December 7 the quarter boat was dropped downstream to mouth of Little Sunflower River, the party doing such work as was found to be necessary on the way. Work was stopped December 7 by the sudden death of Mr. John Schuh, the overseer in local charge. Mr. Schuh came to Vicksburg by steamboat December 3 to consult a physician and procure medicine. He returned to the work by steamboat the afternoon of December 5, though urged to remain and receive proper medical attention until he should be restored to health, but he claimed to be much better and insisted upon going back. After reaching the quarter boat in Lower Yazoo River he grew worse rapidly and died the morning of December 7, beyond means of care and attention, except such as was given by willing but ignorant laborers employed under him. His death deprived this district of one of its most efficient workers, and it is feared that his conscientious zeal, untiring energy, and constant interest in the work on which employed may have caused him to undergo undue hardship and exposure which resulted in his death. Thus within a few months the work lost the services of two most efficient employees whose places will be hard to fill.

The following is a summary of the work done by the force employed under Overseer Schuh, July 4 to December 7, 1898, viz:

Channel snags pulled, cut, and destroyed	6,018
Shore snags cut and destroyed	3,534
Stumps pulled, cut, and destroyed	5,155
Logs removed from channel	3,226
Logs cut and destroyed	6,276
Side jams removed	11
Leaning trees cut and destroyed	10,468
Leaning trees topped	1,498
Trees girdled	33,487
Square yards of willows and brush cut	2,795
Brush wing dams built (175 feet long, 5 feet wide, and 4 feet high)	1

Wrecks removed, viz: Part of steamer *Blanks Cornwall* (sunk January 14, 1896), one-fourth mile below Dewdrop; part of old wreck (unknown) at Sycamore Mound; and steamer *Fifteen* (sunk October 30, 1897) at head of Honey Island.

The snag boat *John R. Meigs* was a large single-hull iron and steel boat, 172 feet long and 38 feet wide, with good motive and superior snagging power, the latter consisting of a pair of oscillating engines under the forecastle deck and four large independent reversible capstans. After long experience I should place the *Meigs* ahead of the largest snag boat in use for efficiency, service, and economy, both in first cost and for running expenses. The boat was built at Carondelet, Mo., in 1879. The record of its cost is not available, but from the files of this office it appears that the expenditures for construction and outfit aggregated a little more than $75,000. Making allowances for the reduced cost of material, though better than that of twenty years ago, it is estimated that a similar boat, equipped and ready for service, will cost $60,000. Such a vessel is much needed to replace the *Meigs* for work in Yazoo River and tributaries, and when not so employed can be used to advantage upon other works of the district.

With this addition, I repeat the estimates and recommendations contained in my reports for the past five years, respecting the streams of the Yazoo system, viz:

> Work in Yazoo and tributary streams could be carried on more economically if they were grouped together as a system and appropriations made under one head, with allotments for each stream. The plant could then be bought from the general appropriation and its use charged pro rata without being a heavy burden upon any one stream. A modern dredge, preferably self-propelling, would be of great use in parts of Yazoo, Tchula Lake, and Big Sunflower, but the largest appropriation of late years for any one of the streams mentioned would not be sufficient for the purpose. So also with regard to pile drivers, quarter boats, or small hand-snagging outfits, the idea being to have a district plant, to be used on any of the streams of

the system when needed. The estimates are made with this view, the work required not being of a kind that can be done advantageously or satisfactorily by contract. A great deal of work remains to be done in clearing the banks of leaning timber to prevent tree slides and snags and to make the passage of the sharp bends safer, and this can be done most economically by shore parties housed and subsisted on quarter boats, leaving the heavy work to be done at the proper or convenient time by the snag boats. There are also many places where the channel is injured by dispersion, and where chutes should be closed or wing dams built. As Yazoo and tributaries are not subject to heavy drift, work of the kind need not be expensive, and probably sheet piling would answer very well.

DETAILED ESTIMATES.

New snag boat		$60,000
General service plant:		
Dredge	$30,000	
Pile driver	4,000	
Quarter boats	2,500	
Skiffs, tools, rigging, etc	3,500	
		40,000
Service of plant:		
Expenses of snag boats	24,000	
Expenses of dredges	9,000	
Expenses of shore parties	7,000	
		40,000
Care of plant:		
New boilers	4,000	
Hull repairs	3,000	
General and extraordinary repairs	1,500	
Fleet, wages, supplies, etc	1,500	
		10,000
Surveys: Local surveys, gauges, discharge measurements, etc		6,000
Administration:		
Office expenses, rent, supplies, etc	1,500	
Assistant engineers, draftsmen, transportation, and incidentals	2,500	
		4,000
Total		160,000

Money statement.

July 1, 1898, balance unexpended	$17,636.07
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	37,636.07
June 30, 1899, amount expended during fiscal year	5,133.44
July 1, 1899, balance unexpended	32,502.63
July 1, 1899, outstanding liabilities	1.01
July 1, 1899, balance available	32,501.62
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	160,000.00

The amount expended during the year and balances July 1, 1899, were as follows:

Allotments.	Expended during year.	Balances July 1, 1899.
For general improvement, care of plant, etc	$5,133.44	$25,406.49
For constructing pumping dredge boat (act August 11, 1888)		2,096.14
For removing bar at Yazoo City (act June 3, 1896)		5,000.00
Total	5,133.44	32,502.63

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1873	$40,000	August 5, 1886	$15,000
March 3, 1875	12,000	August 11, 1888	32,000
August 14, 1876	15,000	September 19, 1890	25,000
June 18, 1878	25,000	July 13, 1892	20,000
March 3, 1879	15,000	August 18, 1894	20,000
June 14, 1880	12,000	June 3, 1896	20,000
March 3, 1881	6,000	March 3, 1899	20,000
August 2, 1882	8,000		
July 5, 1884	10,000	Total	295,000

COMMERCIAL STATISTICS.

Yazoo River was navigable the entire year. There was no interruption of traffic by bar formation at the mouth. The lowest stage upon the Vicksburg gauge during the year was 8.57 feet, 15.1 feet above extreme low water.

List of steamboats engaged in navigating Yazoo River during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Rescue	Stern-wheel.	135.4	126	24.3	3.7	2 0	3 4	Yazoo City and Belzona	124	750
Ashland City	do	94.55	120	20	3.9	2 2	3 9	Vicksburg and Big Sunflower River.	1	....
								Yazoo City and Big Sunflower River.	150	900
								Yazoo City and Belzona	8	50
								Yazoo City and Vicksburg.	10	....
Elk	do	111.22	153	22	4	2 2	4 0	Yazoo City and Belzona	24	120
								Yazoo City and Vicksburg.	2	....
E. A. Pharr	do	95.11	90	29.9	4.5	1 10	3 0	Greenwood, Honey Island, and Tallahatchie River.	72	300
City of Greenwood.	do	....	130	28	......	1 6	4 0	Vicksburg and Tallahatchie River.	25	750
Rees Pritchard	do	196.2	150.3	31	3.3	1 6	3 3	Vicksburg and Greenwood.	52	400
Gus Fowler	do	309.62	160	29.5	5.6	2 8	6 0	do	4	....
Hibernia	do	157	135	25	4	1 6	4 6	Vicksburg and Big Sunflower River.	22	220
Mary Joyce *a*	do	54.2	65	14	2.4	11	1 10	do	2	....
Maggie	do	50.73	85	19	3.5	1 6	3 0	Yazoo City and landings below.	104	....
Lake Palmyra	do	141.16	123.5	26	4.8	2 6	4 6	Vicksburg and Big Sunflower River.	13	92
Josie Sively	do	46	88	20.3	3.1	11	2 6	do	27	67
Ruth	do	319.4	160	31.5	5	3 0	6 6	do	9	100
Alarm *b*	do	189.09	142	26	4.3	3 6	6 0	New Orleans and Big Sunflower River.	1	....
								New Orleans and Yazoo River.	2	....
Henry Marx *b*	do	357.35	138	30	4.5	3 4	5 6	do	2	....
Novelty *a*	do	83.65	76.4	16.4	3	1 6	3 6	Vicksburg and Big Sunflower River.	4	....
C. H. Woods	do	70.83	110	22	3.2	1 8	1 8	(Sawmill boat operating in Yazoo River and tributaries.)	....	....
Eva Alma *b*	do	....	......	......	......	......	......	(No report. Towing saw logs from Yazoo and Big Sunflower rivers.)	....	....
Electric	do	34.57	77.6	20	2.8	......	......	(Show boat.) Local trips near Greenwood.	....	....
Ferd R	do	45.58	93.8	16.2	3	2 0	3 0	(No report.)	....	....
Yazonia *a*	do	62.84	96	19.8	3.5	1 3	3 6	Greenwood and Tallahatchie River.	98	....
Morning Star	do	86.6	95	20.4	2.4	2 2	3 0	Local trips near Yazoo City.	....	....
Columbia	do	75	116	24	3	2 6	3 6	Vicksburg and Big Sunflower River.	1	....
Joe Seay	Tug	27.74	75	16	6	7 0	8 0	....	....	....

a With one or more barges. *b* Towboats.

The steamer *Novelty* burned at Vicksburg February 11, 1899, and the steamer *Yazonia* burned at Glendora, Miss., in June, 1899.

Summary of commerce reported.

Articles.	1898-99.	1897-98.	1896-97.	1895-96.	1894-95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	8,801	11,571	21,163	14,403	17,037
Cotton seed	12,985	28,765	32,147	17,150	19,432
Hides and skins	25	2	12	12	11
Live stock	248	25	120	52	47
Lumber	4,150	600	2,450	1,613	10,080
Staves	11,132	12,156	14,264	23,740	10,623
Provisions	5,250	2,750	14,175	13,520	13,325
Grain	4,625	7,000	7,380	7,018	13,760
Saw logs	6,000	11,000	40,200	31,200	11,000
Miscellaneous	7,394	8,220	15,400	18,863	17,725
Total freights for Yazoo proper	60,610	82,089	147,311	127,571	113,040
Total freights from tributaries	41,488	43,101	57,546	85,374	107,551
Total freight Yazoo and tributaries	102,098	125,190	204,857	212,945	220,591
Estimated value	$4,215,000	$2,840,000	$3,218,000	$3,619,000	$4,806,000

Articles.	1893-94.	1892-93.	1891-92.	1890-91.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	15,815	11,094	15,653	13,750
Cotton seed	17,355	12,796	16,570	12,500
Hides and skins	10	26	19	10
Live stock	60	79	124	60
Lumber	3,200	3,122	3,318	3,600
Staves	14,447	12,488	6,864	1,350
Provisions	12,020	8,547	10,502	9,020
Grain	14,280	6,107	12,531	11,080
Saw logs	22,400	11,800	15,000	2,140
Miscellaneous	12,200	8,507	12,624	10,540
Total freights for Yazoo proper	111,787	74,565	93,205	64,050
Total freights from tributaries	136,394	124,887	116,021	97,588
Total freight Yazoo and tributaries	248,181	199,452	209,226	161,638
Estimated value	$8,314,000	$4,329,000	$7,351,500	$6,315,275

Receipts and shipments of bales of cotton at Greenwood and Yazoo City, Miss.

Routes.	Greenwood.					
	1898-99.		1897-98.		1896-97.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Southern Rwy	18,909	28,809	18,480	33,080	9,962	19,962
Illinois Central R. R	7,702	15,390	8,107	25,570	4,521	17,006
River	18,476	11	21,843	250	20,808	396
Wagon	3,176	....	13,373	....	2,500	....
Total	48,263	44,210	61,803	58,900	37,791	37,364

Routes.	Yazoo City.					
	1898-99.		1897-98.		1896-97.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Illinois Central R. R	10,575	52,211	22,388	77,495	13,353	56,102
River	23,700	2,054	43,219	16,911	22,618	2,309
Wagon	22,828	....	30,807	....	23,292	....
Total	57,103	54,265	96,414	94,406	59,263	58,411

When the mouth of the river is closed to navigation, the sources of supplies for Yazoo and tributaries are Yazoo City and Greenwood.

The Georgia Pacific division of the Southern Railway crosses Yazoo River at Fort Loring, 5 miles below Greenwood, and the Yazoo and Mississippi Valley Railroad crosses about 15 miles above the mouth. The latter has a branch from Clarksdale to Philipp, on the Tallahatchie, connecting with a branch of the Georgia Pacific to Greenwood. The Yazoo branch of the Illinois Central Railroad, from Parsons, on the Yallabusha, to Jackson, Miss., runs parallel to the river, touching at Greenwood, Sidon, Tchula, and Yazoo City, and has a tap line from Tchula to the main line at Durant. The Yazoo and Mississippi Valley Railroad is extending the Tallahatchie branch to and across Yallabusha River, to connect with the Yazoo branch of the Illinois Central a short distance north of Greenwood and give a through line from Clarksdale to Greenwood, and it is understood that the same road contemplates building another line down the east side of Big Sunflower River from an intersection with the Tallahatchie branch.

W 9.

IMPROVEMENT OF MOUTH OF YAZOO RIVER AND HARBOR AT VICKSBURG, MISSISSIPPI.

Proposals for what is termed contract No. 3, for excavation for diverting mouth of Yazoo River by the new outlet past Vicksburg, were advertised March 2, 1899, under War Department authority dated February 23, 1899. Nine bids were received, as shown upon the abstract appended to this report, and opened at this office April 5, 1899. By letter from Office of the Chief of Engineers dated June 1, 1899, the contract was awarded to the Stone, Sand, and Gravel Company of New Orleans, La., the lowest bidder for the work, at the rate of 8.49 cents per cubic yard. Contract was entered into June 14, 1899, with bond for its fulfillment in the sum of $75,000. The contract calls for excavation of 7,500,000 cubic yards of earth along the diversion route selected, with provision that it may be increased or diminished 25 per cent.

Under terms of the proposal and contract work is required to begin by December 5, 1899, with sufficient force and plant for an output of not less than 260,000 cubic yards per month, which is to be increased within six months from date of beginning to give an output of not less than 330,000 cubic yards of excavation per month. If work is commenced before December 5 it is required that the plant first put in operation shall have an assured capacity of not less than 65,000 cubic yards per month. The work is to progress at these rates unless stopped or impeded by floods, storms, epidemics, or other causes beyond control, as may be decided by the engineer officer in charge and approved by the Chief of Engineers.

The work was let under the continuous-contract method, as authorized by river and harbor act of June 3, 1896. The approximate cost of inspection, superintendence, etc., can not be arrived at until the number and kind of machines to be used by the contractors are known, but the balance available is ample for operations during the fiscal year ending June 30, 1900. To provide for prompt payments when due the contractors, and to complete the project for this improvement, an appropriation should be provided for the fiscal year 1901.

Money statement.

July 1, 1898, balance unexpended		$514, 752. 39
June 30, 1899, amount expended during fiscal year		3, 262. 25
July 1, 1899, balance unexpended		511, 490. 14
July 1, 1899, outstanding liabilities	$32. 36	
July 1, 1899, amount covered by uncompleted contracts	636, 750. 00	
		636, 782. 36
Amount (estimated) required for completion of existing project		510, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1901.		510, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

List of appropriations made.

Date of act.	Purport.	Amount.
July 13, 1892	Improving mouth of the Yazoo River, Mississippi, in accordance with plan of Capt. J. H. Willard, dated February 4, 1892, contained in House Ex. Doc. No. 125, Fifty-second Congress, first session, including borings and gauges. Should the Secretary of War be unable to obtain such right of way as may be necessary in the prosecution of this work, upon reasonable terms, by agreement, purchase, or voluntary conveyance, he is hereby authorized to apply at any term of the circuit or district court of the United States for the western division of the southern district of Mississippi, and in the name of the United States institute and carry on proceedings to condemn such lands as may be necessary for right of way as aforesaid, and in such proceedings said court shall be governed by the laws of the State of Mississippi, so far as the same may be applicable to the subject of condemning private property for public use.	$75, 000
Aug. 18, 1894	Improving mouth of the Yazoo River, Mississippi, continuing improvement, to be expended in accordance with plan of Capt. J. H. Willard, as set out in House Ex. Doc. No. 125, Fifty-second Congress, first session	225, 000
Do	Improving harbor at Vicksburg, Miss., not including work at Delta Point, Louisiana, continuing improvement under the direction of the Secretary of War	40, 000
June 4, 1897	For continuing improvement of mouth of Yazoo River and harbor of Vicksburg	350, 000
	Total	690, 000

The river and harbor act of June 3, 1896, provided for completion of the work by the following item, viz:

> Improving mouth of Yazoo River and harbor of Vicksburg, Miss.: For the purpose of completing the project of improvement as heretofore adopted and entered upon, in addition to expending the balance on hand, contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the same, or said materials may be purchased and work may be done otherwise than by contract, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $860,000, exclusive of the amount heretofore appropriated.

Payments for obligations that may be incurred under this act are limited by section 5, as follows:

> SEC. 5. That under the authority to make contracts for materials and work, under the provisions of this act, in addition to the sums appropriated herein, the Secretary of War shall not obligate the Government to pay, in any one fiscal year, beginning July 1, 1897, more than $400,000 upon the said contracts for any one of the works herein placed under the contract system, except as herein otherwise specifically authorized to do: *Provided,* Any part of the annual allotment herein provided for, not earned and paid for material furnished or work done in one fiscal year, may be paid for material furnished and work done under the contracts in any subsequent fiscal year: *Provided, further,* That nothing herein contained shall be so construed as to prevent the Secretary of War from making contracts for the whole or any part of the works placed under the contract system in such manner as may be deemed best, payments, however, to be made as stated in this section.

Abstract of proposals for excavating 7,500,000 cubic yards of earth, more or less, along route for diverting mouth of Yazoo River, near Vicksburg, Miss., under continuous contract, received in response to advertisement dated March 2, 1899, and publicly opened at United States engineer office, Vicksburg, Miss., at 3 o'clock p. m., April 5, 1899, by Maj. J. H. Willard, Corps of Engineers.

No.	Name and address of bidder.	Price per cubic yard.	Total amount.
		Cents.	
1	Washburn & Washburn, Chicago, Ill	$12\frac{1}{4}$	$918,750
2	John Shields, Flemington, N. J	$9\frac{87}{100}$	740,250
3	G. M. Garvey & Co., 439 Adams street, Memphis, Tenn	$22\frac{1}{2}$	1,687,500
4	Stone, Sand and Gravel Co., 205 Cora Building, New Orleans, La. *a*	$8\frac{49}{100}$	636,750
5	Hingston & Woods, 24 West Swan street, Buffalo, N. Y	$11\frac{1}{2}$	862,500
6	Atlantic, Gulf and Pacific Co., World Building, New York, N. Y	$8\frac{89}{100}$	666,750
7	Rittenhouse Moore Dredging Co., Mobile, Ala	16	1,200,000
8	Charles Clarke & Co., Galveston, Tex	$9\frac{4}{10}$	705,000
9	Christie, Lowe & Heyworth, 171 La Salle street, Chicago, Ill	$9\frac{1}{2}$	712,500

a Bid accepted; work not begun.

COMMERCIAL STATISTICS.

During the fiscal year the canal or harbor from Kleinston to the city front at the foot of Crawford street was completely closed to navigation during the following periods: July 21 to August 20; September 1 to January 5. For stages less than 32 feet on the Kleinston gauge the route through the Willow Pass had to be used.

The gauge heights required for the various lines of boats to reach the city landing were about as follows: The Vicksburg and Delta ferryboat and the Yazoo and Big Sunflower river packets, about 23 feet; the Vicksburg, Greenville, and New Orleans boats, about 28 feet; the Anchor Line, about 33 feet. The city wharf boat—a large and bulky vessel—required about 36 feet, on account of the narrow and crooked channel in the Willow Pass. Mississippi River was blocked by ice February 13 to 18, 1899.

List of steamboats arriving at and departing from Vicksburg during the fiscal year 1899.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Arrivals.	Departures.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Hill City	Side-wheel.	1,038.25	275	45	8	8 8	....	20	20	....
City of St. Louis	...do..	1,614.02	300	49	8.8	3 6	9 0	12	12	64
Buckeye State	Stern-wheel.	669.92	252.3	39.2	6.8	3 0	9 0	20	20	50
John K. Speed	...do..	1,090.27	261	42	8.6	3 6	10 0	21	21	62
New South	...do..	846.55	257	42.6	7	4 0	10 0	13	13	45
State of Kansas	...do..	1,130.34	252	52.6	6	2 6	7 0	20	20	30
City of Pittsburg	...do..	....	....	....	....	....	....	2	2	....
City of Chattanooga	...do..	261	144	30	5.5	....	....	2	2	....
Lucille Nowland	...do..	357	180	34	5	1 7	5 0	34	34	683
Ouachita	...do..	457.45	189	38	6.5	4 0	9 6	38	38	411
Julia	...do..	451	....	....	....	2 6	6 0	3	3	28
Quickstep	...do..	66	106	20.5	4	....	....	1	1	....
Liberty	...do..	351	164	34.4	5	....	....	13	18	....
Belle of the Bends	Side-wheel.	658	210	32	7	3 6	7 0	150	150	3,000
Annie Laurie	Stern-wheel.	199.81	138	27	4.8	3 0	5 0	30	30	300
Ruth	...do..	319.4	160	31.5	5	8 0	6 6	10	10	30
Saint Joseph	...do..	277.13	170	32	4.9	3 0	7 6	156	156	15,000
Providence	...do..	6	45.8	10.9	3.8	....	....	78	78	2,451
Jo Long	...do.	129	120.3	21.3	4.6	2 0	4 0	1	1	....
Mattie M	...do..	144.25	95	24	2.8	1 8	3 6	4 trips a day; ferryboat.		14,600
T. P. Leathers	...do..	509.47	220	40	6.5	4 0	9 0	34	34	403

List of steamboats arriving at and departing from Vicksburg, etc.—**Continued.**

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Arrivals.	Departures.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Natchez	Stern-wheel.	584.99	225	40	8	4	0	8	6	32	32	......
Chalmette	Side-wheel.	1,436	......	......	......	5	0	11	0	36	36	929
Dewey	...do ..	665	......	......	......	4	0	9	0	22	22	352
John Howard	Stern-wheel.	447.52	184.6	37.8	6.3	3	0	7	6	22	22	845
City of Greenwood	...do ..	......	......	......	......	1	6	4	0	25	25	750
Atlanta *a*	...do ..	85.03	93	16.4	3.7	2	2	3	0	1	1	......
Lake Palmyra	...do ..	141.16	123 5	26	4.8	3	0	4	6	24	24	170
Novelty *a*	...do ..	83.65	76.4	16.4	3	1	6	3	6	30	30	......
Rees Pritchard	...do ..	196.2	150.3	31	3.3	1	6	3	3	52	52	400
Gus Fowler	...do ..	309.62	160	29.5	5.6	2	8	6	0	5	5	......
Mary Joyce *a*	...do ..	54.20	65	14	2.4	1	1	2	0	15	15	......
Hibernia	...do ..	157.06	135	25	4	2	0	4	0	22	22	220
Rescue	...do ..	135.4	126	24.3	3.7	1	10	3	0	1	1	......
Ashland City	...do ..	94.55	120	20	3.9	2	2	4	0	12	12	......
Josie Sivley *a*	...do ..	46	88	20.3	3.1	1	1	2	0	24	24	67
Eva Alma *b*	...do	......	......	......	......	......		......		4	4	......
Joe Seay, harbor tug	Tug ..	27.74	75	16	6	6	5	8	0	......	......	......
Josephine Loviza *b*	Stern-wheel.	93.25	113.6	22.2	3.7	2	4	3	6	2	2	......
L. E. Patton *b*	...do ..	94	126	24.5	4.5	......		......		3	3	......
Valley Queen	...do ..	410.83	190.6	35.8	5.6	3	0	8	5	13	13	845
Crescent *b*	...do ..	239.96	144	28	5	3	5	5	0	6	6	......
Alarm *b*	...do ..	189.09	142	26	4.3	3	5	4	5	4	4	......
Resolute *b*	...do ..	207.78	139.6	29	3.9	3	0	4	3	4	4	......
Henry Marx *b*	...do ..	357.35	138	30	4.5	3	6	4	6	8	8	......
T. A. Hendricks *b*	...do ..	81.86	108	22.5	4.2	4	2	5	0	2	2	......
Betsey Ann, new boat	......	......	......	......	......	......		......		1	1	......
America	Stern-wheel.	427	200	53	8	4	0	11	0	1	1	......
U and I *a*	...do ..	87	......	......	......	1	2	3	0	1	1	......
Julian Poydras, new boat	.. do ..	......	......	......	......	......		......		1	1	......
Saint James, new boat	...do ..	......	......	......	......	......		......		1	1	......
Paul Jones	Yacht	......	......	......	......	......		......		1	1	......
Troubadour	...do ..	15.5	74	10	4	......		......		1	1	......
Elk	Stern-wheel.	111.22	153	22	4	2	0	4	0	3	3	......
Victoria *a*	La'nch	12	47.5	11	2.4	......		......		4	4	......
S. H. H. Clark *b*	Stern-wheel.	711	210	37.6	6.2	......		......		3	3	......
Smoky City *b*	...do ..	549	194	35	6	......		......		2	2	......
Jim Wood *b*	...do ..	402	169	32.2	5.8	......		......		3	3	......
John A. Wood *b*	...do ..	687	198	40	7	......		......		1	1	......
Jas. B. Williams *b*	...do ..	801	210	40	6.5	......		......		3	3	......
W. W O'Neil *b*	...do ..	778	201	46 2	8	......		......		5	5	......
Boaz *b*	...do ..	623.3	193	44.4	6.5	......		......		2	2	......
Defender *b*	...do ..	514.85	177	41	7.3	......		......		2	2	......
Oakland *b*	...do ..	628	210	35	6	......		......		1	1	......
J. M. Bowell *b*	...do ..	107	115	23	3.8	......		......		1	1	......
Joseph Henry	Side-wheel.	340	180	32	5.8	......		......		6	6	......
J. N. Macomb	...do ..	800	176.9	62	7	......		......		4	4	......
Mississippi	Stern-wheel.	390.14	174	32	6	......		......		2	2	......
Vidette	...do ..	125.44	118.2	23 8	3.7	......		......		1	1	......
Arthur Hider, new boat	...do ..	......	......	......	......	......		......		4	4	......
Emma Ethridge	...do ..	188.45	128	26.1	5	......		......		2	2	......
Patrol	...do ..	163	130.8	29	4.9	......		......		1	1	......
Genl. John Newton	...do ..	......	149	23	7.9	......		......		1	1	......
Thomas B. Florence	...do ..	60	96	20	4	......		......		......	......	......
Nashville (U. S. Navy)	Screw	907	220	38.1½	11	......		......		1	1	......
H. F. Frisbie *b*	Stern-wheel.	270	169.4	32.2	5.8	......		......		1	1	......
Gleaner *b*	...do ..	714	185	35	5	......		......		1	1	......
Belle of Calhoun	...do ..	451	180.9	36.4	4.7	......		......		6	6	......
Fred Wilson *b*	...do ..	523	174	30.8	5.4	......		......		1	1	......
Henry Lowrey *b*	...do ..	646	209.6	35.2	5.8	......		......		1	1	......
Columbia	...do ..	75	116	24	3	......		......		1	1	......

a With one or more barges. *b* Towboat.

Summary of commerce reported.

Articles.	1898–99.			1897–98.		
	Yazoo River and tributaries.	Mississippi River.	Total.	Yazoo River and tributaries.	Mississippi River.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	16, 429	7, 277	23, 706	15, 120	7, 129	22, 249
Cotton seed	22, 984	27, 537	50, 521	40, 706	29, 365	70, 071
Coal	....	25, 000	25, 000	....	15, 000	15, 000
Lumber	6, 010	2, 744	8, 754	1, 070	3, 069	4, 139
Saw logs	13, 000	17, 000	30, 000	21, 000	10, 000	31, 000
Staves	19, 214	252	19, 466	26, 239	1, 362	27, 601
Live stock	553	1, 091	1, 644	76	3, 514	3, 590
Hides and skins	88	89	177	5	238	243
Grain	6, 253	15, 244	21, 497	7, 240	20, 913	28, 153
Provisions	9, 502	13, 516	23, 018	4, 587	19, 987	24, 574
Miscellaneous	8, 065	10, 944	19, 009	9, 147	14, 869	24, 016
Total	102, 098	120, 694	222, 792	125, 190	125, 446	250, 636
Estimated value	$4, 215, 000	$2, 586, 000	$6, 801, 000	$1, 826, 000	$5, 450, 000	$7, 276, 000

Articles.	1896–97.			1895–96.		
	Yazoo River and tributaries.	Mississippi River.	Total.	Yazoo River and tributaries.	Mississippi River.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	25, 913	5, 364	31, 277	20, 193	4, 911	25, 104
Cotton seed	44, 449	17, 127	61, 576	29, 161	13, 498	42, 659
Coal	....	15, 000	15, 000	....	15, 000	15, 000
Lumber	3, 924	7, 130	11, 054	4, 487	2, 036	6, 523
Saw logs	46, 200	34, 500	80, 700	37, 000	30, 000	67, 000
Staves	27, 730	730	28, 460	63, 762	180	63, 942
Live stock	696	4, 411	5, 107	191	240	431
Hides and skins	31	111	142	33	133	166
Grain	7, 741	12, 790	20, 531	7, 443	21, 325	28, 768
Provisions	21, 448	21, 851	43, 299	20, 450	15, 495	35, 945
Miscellaneous	26, 725	17, 396	44, 121	30, 225	14, 400	44, 625
Total	204, 857	136, 410	341, 267	212, 945	117, 218	330, 163
Estimated value	$3, 218, 000	$4, 756, 600	$7, 974, 600	$3, 619, 000	$4, 088, 000	$7, 707, 000

The business of the steamers *Chalmette, Dewey, John Howard, and Valley Queen* is not included in above statement of 1898–99 for Mississippi River, the data not having been received.

Receipts and shipments of cotton at Vicksburg, Miss.

[As furnished by Vicksburg Cotton Exchange.]

	1898–99.	1897–98.	1896–97.
	Bales.	*Bales.*	*Bales.*
Receipts	69, 881	93, 185	80, 597
Shipments	66, 912	89, 929	80, 026

The Vicksburg cotton-seed oil mills report the total number of sacks of cotton seed received by river during last fiscal year as 195,920, in 1897–98 as 303,720, and in 1896–97 as 594,300.

Receipts and shipments reported by railroads.

Articles.	1898-99.				1897-98.			
	Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.		Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.	
	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	30,416	34,750	4,852	31,504	37,908	22,822	6,074	29,962
Cotton seed	10,155	10,285	14,153	23,955	2,604	270	13,940	....
Coal	82,650	42,075	6,325	....	44,499	33,385	5,400	....
Lumber	18,520	7,100	2,800	6,038	10,458	7,105	3,840	9,712
Staves	5,200	1,060	....	2,836	2,655	4,580	....	....
Live stock	1,850	1,700	1,740	550	5,686	6,920	3,546	804
Grain	22,880	19,480	14,620	8,103	12,562	13,830	11,895	5,239
Provisions	22,612	15,900	4,095	2,487	17,129	11,690	17,620	6,856
Miscellaneous	49,320	39,190	44,664	9,151	44,794	53,516	44,228	35,250
Total	243,603	171,540	92,749	84,624	178,295	154,118	106,543	87,863

Articles.	1896-97.				1895-96.			
	Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.		Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.	
	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	28,195	38,710	6,235	25,900	27,155	10,255	4,770	26,015
Cotton seed	4,341	....	13,120	....	3,171	....	12,414	....
Coal	33,666	32,948	3,330	....	....	26,007	4,520	....
Lumber	4,648	1,413	2,960	7,220	6,428	8,586	2,120	5,450
Staves	....	....	....	....	....	755	1,470	....
Live stock	1,191	197	1,964	780	418	1,163	....	520
Grain	7,877	36	10,900	5,450	3,130	6,225	4,732	2,392
Provisions	77,062	5,469	12,726	6,875	10,771	6,382	8,455	6,206
Miscellaneous	18,495	67,474	41,457	32,666	14,418	77,686	35,341	28,835
Total	175,475	146,247	92,692	78,891	65,486	132,059	73,822	69,417

	1898-99.	1897-98.	1896-97.	1895-96.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Total receipts by railroads	336,352	284,838	268,167	139,308
Total shipments by railroads	256,164	241,981	225,138	201,476

W 10.

IMPROVEMENT OF TALLAHATCHIE RIVER, MISSISSIPPI.

No work for continuing the improvement of this stream was done during the fiscal year ending June 30, 1899, no money having been available for the purpose until the passage of the river and harbor act of March 3, 1899. It is expected to apply the funds appropriated by that act to the removal of snags, logs, leaning timber, etc., obstructing navigation, during the period of lowest water this summer and fall.

New obstructions are brought into the river each year by drift and sliding and caving banks; snags or logs embedded in the bottom are disclosed or lodged upon bars from time to time by the shifting and scouring of the channel, and the growth of timber along the banks is rapid. In the project of 1879 it was proposed to complete the work then required in two seasons at a probable cost of $40,000, but the appropriations made for twenty years' work have aggregated $50,500, of which sum $10,000 was required by law to be expended for improvement of the river above mouth of Coldwater. For these reasons the work could not be completed as planned. I estimate that it will require an expenditure of $10,000 in one working season to put Tallahatchie River between the Yazoo and Coldwater rivers in fairly good navigable condition in accordance with the original plan, and that about $2,500 a year will be necessary for maintenance for some time to come. Modification of the project to include these estimates was approved March 21, 1899.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$5,000.00
July 1, 1899, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—		By act of—	
March 3, 1879	$6,000	September 19, 1890	$5,000
June 14, 1880	9,000	July 13, 1892	5,000
March 3, 1881	3,000	August 18, 1894	4,000
August 2, 1882	3,000	June 3, 1896	4,000
July 5, 1884	3,000	March 3, 1899	5,000
August 5, 1886	3,500		
August 11, 1888	5,000	Total	55,500

COMMERCIAL STATISTICS.

The river was reported navigable to Sharkey the entire fiscal year, and from February 1 to April 30 boats ran into Coldwater River as high as Yazoo Pass.

List of stern-wheel steamboats navigating Tallahatchie River in fiscal year 1899.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
					Light.		Loaded.				
		Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Yazonia [a]	62.84	95.0	19.8	3.5	1	3	3	6	Greenwood and Sharkey	98	....
E. A. Pharr	95.11	90	29.9	4.5	1	10	3	5	Greenwood, Sharkey, and Coldwater River to Yazoo Pass.	72	300
City of Greenwood	....	130	28	......	1	6	4	0	Vicksburg and Duncans Landing.	25	750
Rees Pritchard	196.2	150.3	31	3.3	1	6	3	3	Vicksburg and Sharkey	3	....
Mildred	19.76	54.5	11	3.2	2	0	3	0	Greenwood and Coldwater River.	10	....
Electric	34.57	77.6	20	2.8	....		....		Local trips near Greenwood.	....	....

[a] The steamer *Yazonia* burned in June, 1899.

Summary of commerce reported.

Articles.	1898-99.	1897-98.	1896-97.	1895-96.	1894-95.	1893-94.	1892-93.	1891-92.	1890-91.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	2,775	2,375	2,500	2,840	3,033	4,338	3,141	5,588	4,[illegible]
Cotton seed	4,150	9,362	7,170	6,374	6,940	7,300	4,400	8,257	6,[illegible]
Hides and skins	23	3	5	4	2	3	3	53	5
Live stock	78	29	52	45	46	30	30	31	[illegible]
Lumber	1,154	470	910	1,402	1,614	1,400	1,300	1,188	1,[illegible]
Staves	2,955	11,408	3,766	22,217	23,404	14,346	3,447	3,204	9,[illegible]
Provisions	2,015	106	4,206	4,200	4,800	4,700	3,450	5,571	4,[illegible]
Grain	1,628	240	200	200	6,300	6,100	1,800	5,725	4,[illegible]
Saw logs	7,000	10,000	2,000	4,600	20,000	49,500	26,700	24,473	12,[illegible]
Miscellaneous	354	177	1,625	1,690	4,800	5,100	4,100	6,329	5,[illegible]
Total	22,132	34,170	22,434	43,572	70,939	92,817	48,371	60,419	53,[illegible]
Estimated value	$758,000	$735,000	$964,000	$1,167,000	$2,061,000	$2,372,000	$908,000	$2,426,000	$2,115,[illegible]

The Yazoo and Mississippi Valley Railroad, operated by the Illinois Central Company, has a branch line from Clarksdale to and across Tallahatchie River at Philipp, which is paralleled by a branch of the Southern Railway from Webb to Ittabena, and the Southern Railway and Illinois Central at Greenwood are competitors for the trade of Tallahatchie River. The Yazoo and Mississippi Valley Railroad is extending the Tallahatchie branch from Philipp to Greenwood, where it will connect with the Yazoo branch of the Illinois Central Railroad.

W 11.

IMPROVEMENT OF BIG SUNFLOWER RIVER, MISSISSIPPI.

There were no funds available for continuing this improvement until after passage of the river and harbor act of March 3, 1899. The U. S. snag boat *Columbia*, Robert Elflein, master, which had been employed in Red River, was ordered to work in Big Sunflower River June 10, left Shreveport, La., June 15, and arrived at Vicksburg, Miss., June 20. The boat remained at Vicksburg June 21–26, making some minor repairs, receiving supplies, and awaiting the organization of a chopping party to work along the banks in conjunction with snagging operations in the channel.

The *Columbia*, with a quarter boat in tow, left Vicksburg for Big Sunflower River June 27, entered the river the same day, and at close of the month had proceeded upstream as far as Hollywood. Backwater from the Mississippi made the lower part of the river too high for effective work, hence it was decided to tow the quarter boat upstream as far as the stage would permit the *Columbia* to go. There was no difficulty in crossing Oliphant Bar or Muscle Shoals, but on reaching Hollywood Bar only 21 inches depth of channel was found. After an ineffectual attempt to cut out the channel with the wheel of the snag boat about 300 light piles were cut, and a pile and brush wing dam 160 feet long was built to concentrate the flow and cause scour. An old dam just above, built in 1897, was repaired at the same time.

Operations will continue during the low-water season until the available funds are exhausted, after which it is expected to transfer the forces and plant for work in Yazoo and Tallahatchie rivers.

The following correspondence is given in full to explain the reasons and necessities for the revised estimate, viz:

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., March 14, 1899.

GENERAL: Complying with instructions contained in your letter of 10th instant (file mark 30128), I have the honor to submit the following project for expenditure of the appropriation made by river and harbor act approved March 3, 1899, for "Improving Big Sunflower River, Mississippi. Continuing improvement, $5,000."

The approved plan for this work contemplated the removal of leaning timber, snags, and logs obstructing navigation, and building wing dams to scour a depth of about 40 inches on the bars to afford safe navigation to Clarksdale, about 180 miles above the mouth. The project was submitted by Captain Benyaurd January 2, 1879, who estimated that the work then required could be completed in three to four consecutive years, at a cost of $66,000. (Report Chief of Engineers, 1879, p. 984.) Congress entered upon the project by act of March 3, 1879, and within four years $37,000 were appropriated, and fairly good progress was made. Since 1882 each river and harbor act has appropriated $5,000 for continuing the improvement, allowing an average sum of $2,500 per annum for expenditure until last year, when the act failed, and making the total sum appropriated to the present time $77,000. As new obstructions are added every year by the rapid growth of vegetation along the banks, and by floods, caving and sliding banks, etc., the original project could not be carried out with the means provided, and no revised estimate for completion has been made, as the nature of the work requires that it shall be repeated from time to time. As a matter of fact, the appropriations since 1882 have been applied chiefly to maintaining what was accomplished during the first four years. Attention to this has been invited in each of my annual reports since 1890 (see Report Chief of Engineers, 1898, p. 1640), but Congress has not considered it necessary to make any additional provision for the work.

The people living on and near the upper river are anxious to have the obstructions in the channel and the leaning timber along the banks removed, so that the small steamboats engaged in navigation of this stream may extend their trips farther upstream, especially during the cotton-shipping season, which usually is at low stages. It would be inadvisable, however, to apply the funds to the upper river and leave the lower portion in an obstructed condition, and for this reason little has been done since 1882 above Faisonia, about 144 miles above the mouth, but it has been the endeavor to obtain the best results within the means provided by trying to keep the lower river open to navigation and to extend work upstream as far as practicable. Following this plan, it is proposed to continue the removal of snags, sunken logs, leaning timber, etc., obstructing navigation, and to repair and build wing dams where needed to give increased depth on the bars. The wing dams are inexpensive structures of light piles or logs and brush, requiring no special plant, but adequate to the purpose, especially where the crust of the shoals can be loosened with explosives. Work should be done during the period of low water, when most of the obstructions are visible, and can be removed with greatest ease, and it should be carried from the mouth upstream as far as the funds available will permit, special attention being given to places difficult of navigation at low stages, but as new obstructions are added continually it is impracticable to say where most work will be required. Operations should be continued by hired labor, and it will be necessary to provide all employees with subsistence and shelter. A trial of the contract method in this district upon works of similar kind demonstrated that it was neither economical nor advantageous to the United States.

To complete the work as planned will require an expenditure of about $20,000 in one or two seasons of low water, after which about $3,000 annually will be needed for maintenance, and it is respectfully suggested that authority be given to include these estimates in future reports.

Very respectfully, your obedient servant,

J. H. WILLARD,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, March 21, 1899.

MAJOR: Your letter of the 14th instant, submitting project for expenditure of the appropriation of $5,000, made by the river and harbor act of March 3, 1899, for improving Big Sunflower River, Mississippi, has been received.

The project is approved. The work to be done by hire of labor and purchase of

material in accordance with regulations, that method being most economical and advantageous to the Government.

You are authorized to present in your next annual report the revised estimate for completing this improvement in accordance with existing approved project, together with the estimate for annual maintenance, the reasons and necessities for which to be fully explained in your report.

By command of Brigadier-General Wilson.

Very respectfully, your obedient servant,

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

Maj. J. H. WILLARD,
Corps of Engineers.

(Through the Division Engineer.)

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$5,000.00
June 30, 1899, amount expended during fiscal year	721.19
July 1, 1899, balance unexpended	4,278.81
July 1, 1899, outstanding liabilities	105.14
July 1, 1899, balance available	4,173.67
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1879	$20,000	September 19, 1890	$5,000
June 14, 1880	8,000	July 13, 1892	5,000
March 3, 1881	4,000	August 18, 1894	5,000
August 2, 1882	5,000	June 3, 1896	5,000
July 5, 1884	5,000	March 3, 1899	5,000
August 5, 1886	5,000		
August 11, 1888	5,000	Total	77,000

COMMERCIAL STATISTICS.

List of stern-wheel steamboats engaged in navigation during the year.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
					Light.		Loaded.				
		Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Hibernia	157	135	25	4	1	6	4	6	Vicksburg and Woodburn	22	220
Mary Joyce *a*	54.2	65	14	2.4		11	1	10	......do	1	....
									Vicksburg and Campbellsville.	1	....
Ashland City	94	120	20	3.9	2	2	3	9	Yazoo City and Campbellsville.	150	900
									Vicksburg and Campbellsville.	1	....
Lake Palmyra	141.16	123.5	26	4.8	2	6	4	6	Vicksburg and Lehrton	13	92
Josie Sivley	46	88	20.3	3.1		11	2	6	Vicksburg and Johnsonville.	27	67
Ruth	319.4	160	31.5	5	3	0	6	6	Vicksburg and Faisonia	9	100
Alarm *b*	189.09	142	26	4.3	3	6	6	0	New Orleans and Big Sunflower River.	1	....
Eva Alma *b*	......	......	......	......	......		......		Vicksburg and Woodburn	1	....
Novelty *a*	83.65	76.4	16.4	3	1	6	3	6	.....do	4	....
Maggie	50.73	85	19	3.5	1	6	3	0	Yazoo City and Campbellsville.	2	....
C. H. Woods	70.83	110	22	3.2	1	8	1	8	Sawmill boat, operating at various points.	....	....
Columbia	75	116	24	3	......		......		U. S. snag boat	....	....

a With one or more barges. *b* Towboats.

The steamer *Novelty* burned at Vicksburg February 11, 1899.

Summary of commerce reported.

Articles.	1898-99.	1897-98.	1896-97.	1895-96.	1894-95.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	4,853	1,174	2,250	2,050	3,601
Cotton seed	5,849	2,579	5,132	5,407	5,760
Hides	40	....	14	17	24
Live stock	227	22	524	80	71
Saw logs	....	....	4,000	1,200	2,475
Lumber	706	....	564	557	1,500
Staves	5,127	2,675	9,700	17,805	8,105
Miscellaneous	317	750	9,700	9,372	375
Total down freight	17,119	7,200	31,884	36,488	21,911
Return freight	2,237	1,731	3,228	2,380	2,623
Total	19,356	8,931	35,112	38,868	24,534
Estimated value	$1,100,000	$251,000	$702,000	$783,000	$956,000

Articles.	1893-94.	1892-93.	1891-92.	1890-91.	1889-90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	2,400	2,699	4,118	2,375	2,594
Cotton seed	5,700	5,250	5,450	3,500	3,975
Hides	12	19	12	....	....
Live stock	38	250	265	70	150
Saw logs	5,650	19,000	21,835	15,400	4,000
Lumber	780	1,130	906	920	869
Staves	9,405	9,840	4,430	3,219	5,250
Miscellaneous	2,050	1,088	2,549	2,027	....
Total down freight	26,035	39,276	39,565	27,511	16,838
Return freight	4,285	4,023	7,489	4,473	5,322
Total	30,320	43,299	47,054	31,984	22,160
Estimated value	$988,000	$893,000	$1,354,000	$945,000	$1,240,000

The Yazoo and Mississippi Valley Railroad crosses the river at Clarksdale and thence runs south parallel to the stream at distances varying from 5 to 20 miles. The Georgia Pacific (Sixth) Division of the Southern Railway crosses the river at Baird with a line running from Greenville, on the Mississippi River, to Atlanta, Ga.

It is understood that the Yazoo and Mississippi Valley Railroad Company has purchased a lumber railroad from Ruleville to Moorhead, 20 miles long, along the east side of Big Sunflower River, and contemplates extending it to the Tallahatchie branch.

W 12.

WATER GAUGES ON THE MISSISSIPPI RIVER AND ITS PRINCIPAL TRIBUTARIES.

The present service consists of twenty-two gauges, at which observations at 8 a. m. and 4 p. m. daily were continued during the fiscal year ending June 30, 1899, viz: On Mississippi River, at St. Louis, Mo., Cairo, Ill., Memphis, Tenn., Helena, Ark., mouth of White River, Ark., Lake Providence, La., Vicksburg, Miss., Natchez, Miss., Red River Landing, La., Baton Rouge, La., Donaldsonville, La., and Carrollton (New Orleans) La.; on Ohio River, at Louisville, Ky., head and foot of falls; on Tennessee River, at Florence, Ala.; on Cumberland River, at Nashville, Tenn.; on White River, at Jacksonport, Ark.; on Arkansas River, at Little Rock, Ark., and on Red River, at Alexandria and Shreveport, La., and Garland and Fulton, Ark.

Records of the daily readings were furnished the secretary of the Mississippi River Commission; copy of the Florence record was furnished the engineer officer in charge of Tennessee River; copy of the Carrollton record was sent the assistant engineer at South Pass of the

Mississippi; copy of the Jacksonport record was sent the chief engineer of the Mississippi Levee Commissioners, and district officers, levee commissioners, etc., were furnished copies of records upon application.

The gauges were inspected during the year by Asst. Engineer John Ewens, as follows:

Date.	Gauge station.	Repairs made, etc.
1898. Sept. 21	Alexandria, La	One section of vertical gauge rebuilt from 9 to 13 feet, remaining sections cleaned, and deposits at foot of gauge removed.
23	Shreveport, La	No repairs required.
26	Fulton, Ark	Do.
27	Garland, Ark	Vertical gauge on St. Louis Southwestern Railway bridge rebuilt in 2 sections, viz: 0 to 14.4 and 14.4 to 32 feet, and an additional bench mark established.
30	Little Rock, Ark	Section of vertical gauge on Baring Cross Bridge rebuilt from—2 to 15.5 feet.
Oct. 9	Jacksonport, Ark	No repairs required.
10	Cairo, Ill	Inclined gauge cleaned, heavy deposit of mud removed from lower part and dense growth of weeds from upper. New bulletin needed badly.
12	St. Louis, Mo	Inclined gauge cleaned.
14	Louisville, Ky. (upper)	No repairs required.
14	Louisville, Ky. (lower)	Do.
18	Nashville, Tenn	Vertical section of gauge, from 41 to 56 feet rebuilt, and inclined portion below 41 feet cleaned of débris.
Nov. 3	Memphis, Tenn	On account of slide of banks, vertical gauge above 8-foot mark at foot of Beale street rebuilt anew in 8 sections, viz: 8 to 12.4, 12 to 16.5, 16 to 20, 20 to 26, 23.6 to 28, 28.5 to 34, 29 to 39.1, and 35.5 to 39 feet.
6	Florence, Ala	Vertical gauge on Memphis and Charleston Railroad Bridge rebuilt in 1 section, from —2.1 to 32.6 feet.
8	Helena, Ark	Three sections of vertical gauge rebuilt, viz: 9.5 to 24, 23 to 34.5, and 28 to 48 feet; and brush and weeds removed from in front of bulletin. New bulletin needed badly.
12	Mouth White River, Arkansas.	Eight sections of vertical gauge rebuilt, viz: 14 to 22, 15 to 22, 21 to 27.2, 30 to 36, 35 to 41, 37 to 45, 40 to 46, and 45 to 53.5 feet. New bulletin needed badly.
14	Lake Providence, Louisiana.	Six sections of vertical gauge rebuilt, viz: 8 to 15.4, 10 to 16, 15 to 24.2, 24 to 32.5, 32 to 38.5, and 38.5 to 50 feet. Bulletin repaired so far as practicable and repainted. New bulletin much needed.
24	Natchez, Miss	Three sections of vertical gauge rebuilt, viz: 10 to 31.5, 31.5 to 44.5, and 43 to 53 feet. New bulletin much needed.
28	Red River Landing, Louisiana.	Six sections of vertical gauge rebuilt, viz: 13 to 18, 17 to 25, 25 to 33, 33 to 39, 36 to 44, and 45 to 53 feet. Bulletin moved back about 50 feet on account of caving bank. Bulletin needs repairs.
30	Baton Rouge, La	Six sections of vertical gauge rebuilt, viz: 6 to 14, 12 to 18.2, 18 to 24.4, 24 to 30.2, 30 to 36.3, and 36 to 43 feet. Bulletin needs repairs.
Dec. 2	Donaldsonville, La	Two sections of vertical gauge rebuilt, viz: 6.3 to 17.7, and 17.7 to 35 feet. Bulletin needs repairs.
5	Carrollton, La	Five sections of vertical gauge rebuilt, viz: —3 to 4, 3 to 7.4, 3 to 9.4, 9 to 13.2, and 12 to 20.4 feet. Bulletin and frame painted.
30	Vicksburg, Miss	Two sections of vertical gauge at Kleinston rebuilt, viz: 8 to 23 and 12 to 27 feet.

Itemized statement of expenditures during the fiscal year ending June 30, 1899, submitted in compliance with requirements of section 6 of river and harbor act of 1888.

Observations:		
Pay of 21 permanent gauge keepers from July 1, 1898, to June 30, 1899, inclusive		$3,720.00
Inspections and repairs:		
Pay of assistant engineer, eight months and one day, at $175 per month	$1,405.83	
Traveling expenses of assistant engineer while inspecting gauges	177.69	
Pay of employees hired to assist gauge inspector and to repair gauges and bulletins	25.25	
Material for repair of gauges	235.50	
Drayage and transportation of material for repair of gauges	18.09	
Painting and repair of gauge bulletins	12.00	
Charcoal for heating brands to mark gauges	1.00	
		1,875.36

Office expenses and contingencies:		
Pay of clerk, three months and twenty days, at $100 per month	$366.67	
Stationery	23.61	
Telegram	.21	
Telephone hire	11.93	
		$402.42
Total expenditures		5,997.78
Outstanding liabilities June 30, 1899:		
Land-grant account of Missouri Pacific Railway Company for transportation of gauge material in July, 1898. (Voucher forwarded to Chief of Engineers for settlement by accounting officer of the Treasury October 15, 1898.)		2.22
Total for fiscal year ending June 30, 1899		6,000.00

Money statement.

July 1, 1898, amount allotted for fiscal year ending June 30, 1899	$6,000.00
June 30, 1899, amount expended during fiscal year	5,997.78
July 1, 1899, balance unexpended	2.22
July 1, 1899, outstanding liabilities	2.22
July 1, 1899, amount allotted for fiscal year ending June 30, 1900	5,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1901.	9,600.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The appropriations and allotments for this work have been as follows:

Allotments from general appropriations for examinations, surveys, and contingencies of rivers and harbors by acts of—	
March 3, 1871	$5,000
June 10, 1872	5,000
March 3, 1873	5,000
June 23, 1874	5,000
March 3, 1875	5,000
Specific appropriations by river and harbor acts of—	
August 14, 1876	5,000
June 18, 1878	5,000
March 3, 1879	5,000
June 14, 1880	5,000
March 3, 1881	5,000
August 2, 1882	5,000
Deficiency act of March 12, 1884	2,100
Specific appropriations by river and harbor acts of—	
July 5, 1884	5,000
August 5, 1886	5,000
Allotted from specific appropriation by river and harbor act of August 11, 1888	8,700
Deficiency act of October 19, 1888	3,600
Allotments from permanent appropriation made by section 6 of river and harbor act of August 11, 1888, for fiscal years, viz:	
1890	9,000
1891	8,700
1892	5,100
1893	5,500
1894	5,500
1895	5,500
1896	5,500
1897	5,500
1898	5,500
1899	6,000
Total	141,200

The following statement shows the disposition of the funds apportioned to this work:

Amount expended to June 30, 1899	$131,087.88
Amount of deficiency appropriation of October 19, 1888, not used	3,600.00
Balance of appropriation by act of August 11, 1888, not expended	1,566.29
Balance of allotment for fiscal year 1890, not expended	1,281.66
Portion of allotment for fiscal year 1891 withheld at United States Treasury under ruling that only $6,000 can be drawn each fiscal year	3,518.34
Balance of allotment for fiscal year 1896, not expended	145.83
Total, as above	141,200.00

Comparison of highest water of fiscal year 1899 with highest previously recorded since establishment of present gauges.

Gauge stations.	Year gauge was established.	Elevation of gauge zero above Cairo datum plane.	Elevation of gauge zero above mean Gulf level at Biloxi, Miss. *a*	Highest water previously recorded on present gauge.		Highest water during fiscal year ending June 30, 1899.		Relation to previous highest record.
				Date.	Gauge reading.	Date.	Gauge reading.	Below.
		Feet.	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Louis, Mo	1871	400.23	378.97	May 19, 1892	35.95	Apr. 26, 27	25.60	10.35
Cairo, Ill	1871	290.84	269.58	Feb. 27, 1883	52.17	Apr. 2	46.24	5.93
Memphis, Tenn	1871	203.97	182.71	Mar. 20, 1897	37.68	Apr. 1-11	35.20	2.48
Helena, Ark	1871	161.98	140.72	Apr. 4, 1897	51.75	Apr. 12-15	46.75	5
Mouth White River, Ark.	1871	128.73	107.47	Mar. 29, 1897	52.42	Apr. 15, 16	48.49	3.93
Lake Providence, La.	1871	89.62	68.36	Mar. 30, 1897	44.54	Apr. 16-21	41.65	2.89
Vicksburg, Miss	1871	66.04	44.78	Apr. 16, 1897	52.45	Apr. 17-23	47.30	5.15
Natchez, Miss	1871	36.89	15.63	May 1, 2, 6, 1897	49.83	Apr. 23-25	46.15	3.68
Red River Landing, La.	1871	23.85	2.59	May 14, 15, 1897	50.20	Apr. 22-27	43.30	6.90
Baton Rouge, La	1871	20.06	− 1.20	May 13-15, 1897	40.65	Apr. 21-28	33.70	6.95
Donaldsonville, La.	1890	*b*19.14	−*b*2.12	May 13, 1897	32.75	Apr. 21	27.50	5.25
Carrollton, La	1872	20.91	− .35	.....do	19.17	.....do	16	3.17
Louisville, Ky. (upper).	1871	*b*419.76	*b*398.50	Feb. 16, 1884	46.60	Mar. 10	32.80	13.80
Louisville, Ky. (lower).	1871	*b*392.85	*b*371.59	.....do	72	.....do	58.30	13.70
Florence, Ala	1871	*b*418.03	*b*396.77	Mar. 19, 1897	32.50	Mar. 20	25.20	7.30
Nashville, Tenn	1873	....	....	Jan. 22, 1882	55.30	Feb. 11	40.60	14.70
Jacksonport, Ark	1871	....	....	Mar. 14, 1890	33.35	May 12	29	4.35
Little Rock, Ark	1871	241.50	220.24	May 21, 1892	31.20	May 11	25.90	5.30
Alexandria, La	1871	64.46	43.20	June 12, 13, 1892	38.25	Jan. 27	18.20	20.05
Shreveport, La	1890	161.27	140.01	May 28, 1892	35.70	Jan. 24	15.60	20.10
Garland, Ark	1890	223.44	202.18	Mar. 24, 1894	28.50	Jan. 17	24.10	4.40
Fulton, Ark	1890	244.78	223.52	May 23, 24, 1892	34.85	.....do	22.55	12.30

a Mississippi River Commission preliminary value, 21.26 feet above Cairo datum plane.
b Preliminary value.

Comparison of lowest water of fiscal year 1899 with lowest previously recorded since establishment of present gauges.

Gauge stations.	Year gauge was established.	Lowest water previously recorded on present gauge.		Lowest water during fiscal year ending June 30, 1899.		Relation to previous lowest record.
		Date.	Gauge reading.	Date.	Gauge reading.	Above.
			Feet.		*Feet.*	*Feet.*
St. Louis, Mo	1871	Jan. 13, 1895	—0.80	Feb. 1	—0.60	0.20
Cairo, Ill	1871	Dec. 24, 1871	—1	Oct. 10	7.67	8.67
Memphis, Tenn	1871	Nov. 6–9, 1895	—2.65	Oct. 12	4.50	7.15
Helena, Ark	1871	Nov. 8, 9, 1895	—3	Oct. 13	7.80	10.80
Mouth White River, Ark.	1871	Dec. 28, 1872	0	Sept. 12	12.80	12.80
Lake Providence, La	1871	Nov. 17, 1895	—5.30	Sept. 14, 15	6.75	12.05
Vicksburg, Miss	1871	Nov. 13, 14, 1895	—6.53	Sept. 14	8.57	15.10
Natchez, Miss	1871	Nov. 13–15, 1895	— .85	Sept. 15, 16	12.48	13.33
Red River Landing, La	1871	Nov. 14, 1895	— .60	Sept. 16	9.46	10.06
Baton Rouge, La	1871	Nov. 14, 1894	.45	Sept. 17	5.41	3.96
Donaldsonville, La	1890	Nov. 11, 1894	1	Sept. 17, 18	4.42	3.42
Carrollton, La	1872	Dec. 27, 1872	—1.60	Dec. 24, 25	1.80	3.40
Louisville, Ky. (upper)	1871	Nov. 14–16, 1895 Sept. 10–14, 18–22, 1881.	1.70	Sept. 26	3.50	1.80
Louisville, Ky. (lower)	1871	Oct. 17, 18, 1872	1.60	Oct. 8	4.30	2.70
Florence, Ala	1871	Sept. 18, 1878	— .76	July 7–11	.50	1.26
Nashville, Tenn	1873	Oct. 15, 16, 1878	— .40	July 14	1.50	1.90
Jacksonport, Ark	1871	Dec. 24, 1872	—1.10	Sept. 11, 12	2.20	3.30
Little Rock, Ark	1871	Oct. 23, 24, 1879	—1	Nov. 18–21	4.80	5.80
Alexandria, La	1871	Sept. 29, 1881	—3.70	Nov. 8	—1.10	2.60
Shreveport, La	1890	Dec. 2–4, 1894	—5.50	do	.20	5.70
Garland, Ark	1890	Sept. 22–25, 1896	— .20	do	1.35	1.55
Fulton, Ark	1890	Sept. 19–25, 1896 Oct. 20–22, 1896	.10	Nov. 7, 8	2.30	2.20

APPENDIX X.

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1899, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, CAPT. WILLIAM L. SIBERT, CAPT. H. C. NEWCOMER, AND FIRST LIEUT. ROBERT McGREGOR, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Removing obstructions in Arkansas River, Arkansas and Kansas.
2. Arkansas River, Arkansas.
3. White River, Arkansas.
4. Buffalo Fork of White River, Arkansas.
5. Upper White River, Arkansas.
6. Cache River, Arkansas.
7. Black River, Arkansas and Missouri.
8. Current River, Arkansas and Missouri.
9. St. Francis River, Arkansas.
10. St. Francis River, Missouri.

ENGINEER OFFICE, UNITED STATES ARMY,
Little Rock, Ark., July 1, 1899.

GENERAL: I have the honor to forward herewith annual report for the fiscal year ending June 30, 1899, for the works under my charge.

Very respectfully, your obedient servant,

ROBERT McGREGOR,
First Lieut., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

X 1.

REMOVING OBSTRUCTIONS IN ARKANSAS RIVER, ARKANSAS AND KANSAS.

Work done.—The snag boat *Sheldon* was used on this work from September 10 to November 8, 1898. From September 10 to October 24, 1898, the work was done under an allotment from the appropriation, title "Improving Arkansas River," where a report of the work done during this time will be found. From October 24 to November 8, 1898, the boat worked over the river from the mouth of White River Cut-off to Bicker Bend, about 46 miles. One hundred and nineteen snags were removed, 7 overhanging trees cut, and 8 drift piles broken up. The boat returned to Newport, Ark., on November 13; the crew was discharged and the boat laid up.

As soon as the appropriation of March 3, 1899, became available, repairs were commenced on the *Beauregard*. These were completed on

June 8, and the *Beauregard* went to Pine Bluff to begin snagging operations at that point. The boat lay there the remainder of the month because the river was at too high a stage for satisfactory work.

Channel.—No opportunity has offered for recent inspections of the river over its entire length. In such portions of it as have been examined (Lawson to Pine Bluff, about 100 miles) at medium stages there were not many snags showing, but the number rapidly increases as the river falls to low stage. The banks of this stream are very unstable, making frequent contributions of fallen timber, and rendering snagging operations a continuing necessity.

Money statement.

July 1, 1898, balance unexpended	$7,655.39
Amount appropriated by river and harbor act approved March 3, 1899	20,000.00
	27,655.39
June 30, 1899, amount expended during fiscal year	4,448.31
July 1, 1899, balance unexpended	23,207.08
July 1, 1899, outstanding liabilities	700.00
July 1, 1899, balance available	22,507.08
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Appropriations for operating snag boats on the Arkansas River have been made intermittently since 1832. Many of the early appropriations were combined with those of other rivers without stated distribution of funds. The estimate of expenditures is not given as absolute, but as a close approximation.

July 3, 1832 (less $38 carried to surplus fund)	$14,962.00
March 3, 1835	40,000.00
March 3, 1837	25,000.00
July 7, 1838 (less $1,115 66 carried to surplus fund)	38,884.34
From appropriations, 1842–1844 (estimate)	80,000.00
August 30, 1852 (less $269.47 carried to surplus fund)	39,730.53
From appropriations, 1866–1878 (disbursements reported by Colonel Suter)	344,831.59
March 3, 1879 (part)	30,000.00
June 14, 1880 (part)	35,000.00
March 3, 1881 (part)	25,000.00
August 2, 1882	35,000.00
July 5, 1884	36,000.00
August 5, 1886	19,875.00
August 11, 1888	25,000.00
September 19, 1890	20,000.00
July 13, 1892	20,000.00
August 18, 1894	20,000.00
June 3, 1896	20,000.00
March 3, 1899	20,000.00
Total appropriations	889,283.46
Expended to June 30, 1898	861,628.07
Unexpended July 1, 1898	27,655.39

COMMERCIAL STATISTICS.

The commerce of this stream is given under the head "Improving Arkansas River, Arkansas."

X 2.

IMPROVEMENT OF ARKANSAS RIVER, ARKANSAS.

Permanent improvement.—On account of the continued high stage of the river after the appropriation of March 3, 1899, became available, nothing was done toward extending the works already built or toward repairing those damaged by the flood of May, 1898.

Survey was made of the river from Little Rock to Cribbs and the notes plotted. The board of engineers appointed by Special Order No. 13, Headquarters Corps of Engineers, March 11, 1899, examined this portion of the river in June, 1899, and adjourned until low-water season to make final examination of the stream.

Plant.—The *Cleveland* was repaired as follows: New wheel, new roof, new after mud drum, new fantail deck; calked above water line; hull and cabin painted. The quarter boat *Charleston* was calked above water line; new rakes, new roof, and new deck were placed. Six barges were repaired for service.

Snagging operations.—Under an allotment of $15,000, provided in appropriation of June 3, 1896, to be expended for removing obstructions, etc., the snag boat *Sheldon* began work on this stream at the mouth of White River Cut-off September 10, 1898. She worked up to Douglas, 61 miles above the mouth of the river, by September 20; remained there until September 28 on account of high water; ran down to Arkansas Post, and worked up to Pine Bluff, 107.5 miles above the mouth, by October 21. Two hundred and seventeen snags were removed, 7 trees cut, and 11 drift piles were broken up.

Under an allotment of $40,000 provided by act of March 3, 1899, from this appropriation title, to be expended in removing obstructions, etc., plans and specifications were prepared and bids invited for a new snag boat for this river, and for a new hull for the *Beauregard.* The *Beauregard* was also repaired for the present season's work. Sixty feet of false gunwales were placed on each side, beginning at forward rake and running aft; new wheel, new after mud drum, and new fantail deck were placed, and main deck patched in many places along guard and forward of boilers. The machinery was thoroughly overhauled.

Condition of the work.—All the works that have been built for the permanent improvement of this stream are more or less in need of repairs. Those in the 20-mile reach just above Little Rock are in especially bad condition. The revetment in Fletchers Bend is practically destroyed. The works at the foot of Greathouse Bend have been flanked, and are in danger of becoming a more serious obstruction than the shoal they were designed to improve.

Recommendations and remarks.—The plant now owned by this appropriation, that is in serviceable condition, consists of one small stern-wheel steamboat 20 feet by 100 feet, fitted with engines 8½ inches in diameter by 3½-foot stroke; six barges, and one quarter boat that will quarter about 32 men.

Pending the action of the board authorized by act of Congress of March 3, 1899, no recommendations are made for continuing the existing project. For maintenance of works already constructed the sum of $50,000 will be required.

Money statement.

July 1, 1898, balance unexpended	$8,865.45
Amount appropriated by river and harbor act approved March 3, 1899	100,000.00
	108,865.45
June 30, 1899, amount expended during fiscal year	10,995.71
July 1, 1899, balance unexpended	97,869.74
July 1, 1899, outstanding liabilities	1,200.00
July 1, 1899, balance available	96,669.74
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement	50,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Prior to 1886 appropriations were made for special works. The act of August 5, 1886, and subsequent acts made appropriations for the improvement of the river in accordance with approved project. The acts of August 17, 1894, and June 3, 1896, also made appropriations for removing obstructions and operating snag boats.

Special work.		
June 14, 1880 (Pine Bluff)	$25,000.00	
March 3, 1881 (Pine Bluff)	23,000.00	
August 2, 1882 (Pine Bluff)	20,000.00	
July 5, 1884 (Pine Bluff)	55,500.00	
July 5, 1884 (Fort Smith)	5,000.00	
August 5, 1886, part (Pine Bluff)	8,000.00	
August 5, 1886, part (Dardanelle)	10,000.00	
August 5, 1886, part (Fort Smith)	13,000.00	
		$159,500.00
Present project.		
August 5, 1886 (part)	44,000.00	
August 11, 1888	150,000.00	
September 19, 1890	180,000.00	
July 13, 1892	250,000.00	
August 18, 1894 (part)	240,000.00	
June 3, 1896 (part)	85,000.00	
March 3, 1899 (part)	60,000.00	
		1,009,000.00
Removing obstructions.		
August 18, 1894 (part)	10,000.00	
June 3, 1896 (part)	15,000.00	
March 3, 1899 (part)	40,000.00	
		65,000.00
Total appropriations		1,233,500.00
Expended to June 30, 1898		1,124,634.55
Unexpended July 1, 1898		8,865.45
Expended to June 30, 1898, on special work		159,500.00
Expended to June 30, 1898, on project		943,025.61
Expended to June 30, 1898, on removing obstructions		22,108.94
Total		1,124,634.55

COMMERCIAL STATISTICS.

The steamboats report the river navigable all the year ending June 1, 1899. Sixteen inches is the shoalest reported between Fort Smith and Webber Falls, 24 inches between Dardanelle and mouth of river. Navigation was stopped by ice from February 6 to February 19, 1899, both dates inclusive.

List of vessels that navigated Arkansas River, Arkansas, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.		Between—	Round trips.	Passengers.
		Steamers.	Barges.			
		Ft. in.	*Ft. in.*			
Irma	131	3 0	3 0	Little Rock and Eagles Little Rock and Roseville Little Rock and Stouts Little Rock and Fourche	17 34 4	1,298
C. E. Taylor	50	22	2 6	Out of Little Rock	5	7
L. E. Patton	92	3 0	4 0	Cut-off and Arkansas City	(?)	....
J. P. Gage	198	2 0	....	Dardanelle and Carden Bottom	1	....
Dewey No. 2	....	2 0	....	Little Rock and Fourche Le Fevre	40	....
Myrtle Corey	10	2 0	3 0	Little Rock and Ross Hollow	20	150
Choctaw	149	4 0	4 0	Little Rock and Stouts	9	17
J. N. Harbin	341	3 6	....	Memphis and Pine Bluff	44	1,040
W. H. Grapevine	220	3 6	....	.....do	7	120
Lucille Nowland	472	5 0	....	.....do	5	168
Dardanelle	160	3 0	3 0	Little Rock and Pine Bluff Little Rock and Carden Bottom	44	413
Myrtle B	47	2 2	....	Fort Smith and Webber Falls Fort Smith and Piney	42	....
Alarm	189	5 0	7 0	New Orleans to Douglas	1	....
Crescent	240	5 3	6 0	New Orleans to Cummings	1	....

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	5,342	4,867	5,605	4,437	4,274
Cotton seed	12,714	22,140	12,285	9,576	9,146
Hides and skins	36	12	30	8	12
Live stock	70	33	158	241	175
Lumber	3,439	637	640	4,112	2,733
Staves and bolts	3,944	12,072	8,175	170	513
Provisions	4,321	1,199	585	3,580	2,033
Grain	2,189	1,279	445	1,579	1,992
Saw logs	24,433	9,811	23,219	19,070	17,400
Hewn piles	341	3,000	11,930	1,545	....
Miscellaneous freights	7,134	3,528	2,975	9,943	12,220
Total freights	63,963	58,578	66,077	54,261	50,498
Estimated value	$2,467,271	$1,626,756	$1,657,218	$2,408,720	$2,380,420

X 3.

IMPROVEMENT OF WHITE RIVER, ARKANSAS.

The work during the fiscal year ending June 30, 1899, has been confined generally to care of property. In August and September, 1898, the snag boat *Sheldon* made a patrol over the river from Black Island to the mouth of White River Cut-off, and found the river in good condition, there being only 15 snags removed and 62 overhanging trees cut in the 258 miles passed over by the boat. As soon as the appropriation of March 3, 1899, became available repairs were begun to the *Sheldon* and to the *Riverside*, to place them in condition for active operations as soon as the rivers fell to suitable stages. The *Sheldon* was calked above the water line, new chimneys, new roof, and new deck between the shears were placed, and the boat was painted. The *Riverside* was calked above water line, some minor repairs made to deck, and the boat painted. A new roof was placed on the dredge *Van Frank* and the hull was calked above water line.

Snagging operations will commence July 1, 1899.

Below Newport the river is in good condition and navigable at its lowest stages by boats of 3-foot draft. The banks are stable and snags do not accumulate rapidly. Above the mouth of black River White River is not navigable all the year.

Remarks and recommendations.—The appropriation of March 3, 1899, completes the amount estimated for the completion of the project. The appropriation of the same date for the improvement of Upper White River by locks and dams separates the stream into two parts. Some provision should be made for the preservation of the channel of the river from the site of the first lock to the mouth of the stream. Also while the locks are building it is more than probable that occasional work will be required in the channel above the locks built. A steam snag boat can probably be employed four months each year on this duty. Counting the working expenses of the boat at $2,000 a month and the expenses while in ordinary at $150 a month, the amount required each year will be $9,200, or the biennial appropriation should be not less than $18,400.

It is thought not worth while to maintain any of the works between Batesville and Buffalo Shoals, as they will be flooded by the pools in the lock and dam system. During the construction of this system, should changes in the channel cause any of the contraction works to become obstructions to navigation, the works so obstructing can be removed with the biennial appropriation mentioned.

To procure and maintain an unobstructed channel the year round from the first lock to the mouth of Black River, it is estimated that $2,500 will be required each year for operating dredge. Including this work with the open river work first mentioned, the biennial appropriation should be $23,000.

Money statement.

July 1, 1898, balance unexpended		$9,669.45
Amount appropriated by river and harbor act approved March 3, 1899		14,815.00
		24,484.45
June 30, 1899, amount expended during fiscal year:		
On White River	$6,092.18	
On Cache River	378.84	
		6,471.02
July 1, 1899, balance unexpended		18,013.43
July 1, 1899, outstanding liabilities		650.00
July 1, 1899, balance available		17,363.43
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		12,000.00

APPROPRIATIONS.

Appropriations for this river have been partly for limited reaches, partly for the whole river, and partly for this river in combination with others.

The appropriations for this river separately, and for reaches of it, are as follows:

June 23, 1874	$50,000	August 5, 1886	$18,000
August 14, 1876	10,000	August 11, 1888	25,000
March 3, 1879	10,000	September 19, 1890	30,000
June 14, 1880	20,000	July 13, 1892	75,000
June 14, 1880	5,000	August 18, 1894	52,000
March 3, 1881	8,000	June 3, 1896	22,000
August 2, 1882	6,000	March 3, 1899	14,815
August 2, 1882	4,000		
July 5, 1884	35,000	Total	384,815

Expended to June 30, 1898	$360,330.55
Unexpended July 1, 1898	9,669.45

COMMERCIAL STATISTICS.

Navigation above the mouth of Black River was suspended on account of low water from August 1 to October 10, 1898. No steamer reports going above Oakland, 121 miles above Batesville. Rafts were floated from points farther up.

List of boats navigating White River, Arkansas, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamers.		Barges.				
		Ft.	*in.*	*Ft.*	*in.*			
Quickstep	66	2	6	5	0	Newport and Buffalo	1	....
Ozark Queen	135	3	0	2	6	....do Newport and McBees Newport and Oakland	22 1	230 ....
F. W. Tucker	100	4	0	3	6	Towing between Clarendon and Negro Hill.	(?)	....
Rex	193	3	6	4	0	Desarc and Clarendon	197	182
Emma	6	3	0	3	0	Devall Bluff and Negro Hill	10	....
A. Saltzman	36	3	0	4	0	Judsonia and Negro Hill	8	....
New Mattie	180	5	0	....		Memphis and Clarendon	45	450
Black Diamond	18	3	0	3	6	Towing to Devall Bluff	(?)	....

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	3,478	4,328	3,860	4,698	4,928
Cotton seed	980	979	1,125	1,098	6,721
Hides and skins	1	61	87	37	90
Live stock	12	40	110	102	101
Lumber	112	6,538	2,865	2,078	4,619
Staves and bolts	7,830	21,184	9,359	6,829	5,208
Provisions	820	334	4,302	1,748	8,005
Grain	300	267	974	725	647
Square timber	1,985	1,660	2,840	....	2,750
Saw logs	79,610	41,038	14,215	13,188	23,751
Railroad ties	....	10,231	14,690	25,125	13,520
Cedar	6,525	12,400	15,810	16,800	2,080
Miscellaneous freights	4,738	3,277	3,725	2,459	1,344
Total freights	105,891	102,337	73,962	74,882	73,759
Estimated value	$1,615,031	$1,415,013	$2,435,814	$2,056,991	$2,494,377

X 4.

IMPROVEMENT OF BUFFALO FORK OF WHITE RIVER, ARKANSAS.

This is a new work. The appropriation of March 3, 1899, is based on the report of a survey made to comply with the requirements of river and harbor act of June 3, 1896. This report is printed on page 1994, Report of Chief of Engineers, 1897. The work proposed is to cut the overhanging timber and remove from the shoals the loose and solid rocks that project above the general plane of the bed of the shoals, from the mouth to the mouth of Rush Creek, 24½ miles.

The estimated cost is $3,500.

Nothing has been done on this work, as the stream has been at too high a stage for satisfactory work since the appropriation of March 3, 1899, became available.

The stream is not navigable all the year, the depths on the shoals being only about 5 inches in the low-water seasons.

Commerce.—Very little steamboating has ever been attempted on this stream. Some flatboating of zinc ore and rafting of cedar poles is done when the stage of river will admit. No record of commerce and no information of any steamboat having been on the river this year could be obtained.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$3,500.00
July 1, 1899, balance unexpended	3,500.00

X 5.

IMPROVEMENT OF UPPER WHITE RIVER, ARKANSAS.

The appropriation of March 3, 1899, which is the first made for this work, is based on a report made to comply with provisions of river and harbor act of June 3, 1896. The report is printed in Report of Chief of Engineers, 1897, page 1992.

The project is to make slackwater navigation from Batesville to Buffalo Shoals by means of ten fixed dams with masonry locks. The estimated cost is $1,600,000.

The distance from Buffalo Shoals to Batesville is 88.75 miles, with an average fall per mile of 1.64 feet. The low-water discharge is about 1,300 cubic feet per second.

The dams are to be of timber cribs filled with stone; the locks to be of concrete masonry 160 by 36 feet, with a lift of about 14 feet and a depth of 4 feet on lower miter sill.

Work done this year.—The river was at too high a stage for survey work until May, 1899. A survey party was then placed in the field to cover the territory from the site of the first lock to that of the second one. This work is nearly completed, and test borings at the probable lock sites to determine the character of the river bottom are in progress. A little preliminary work has been done toward plans for the locks and dams.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899...	$160,000.00
June 30, 1899, amount expended during fiscal year	535.79
July 1, 1899, balance unexpended	159,464.21
July 1, 1899, outstanding liabilities	1,100.00
July 1, 1899, balance available	158,364.21
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	160,000.00

COMMERCIAL STATISTICS.

There was no navigation on this portion of White River between August 1 and and October 10, 1898, on account of low water. Oakland, 121 miles above Batesville, was the highest point to which a steamer went during the year ending June 1, 1899.

List of boats navigating Upper White River, Arkansas, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamers.		Barges.				
		Ft.	*In.*	*Ft.*	*In.*			
Quickstep	66	2	6	5	0	Newport and Buffalo	1	....
Ozark Queen	135	3	0	2	6	....do	22	230
						Newport and McBees		
						Newport and Oakland	1	....

Classification of commerce reported, fiscal year ending June 30, 1899.

	Tons.
Cotton	1,377
Cotton seed	100
Lumber	112
Staves	130
Cedar	6,525
Miscellaneous freights	815
Total freights	9,059
Estimated value	$548,335

X 6.

IMPROVEMENT OF CACHE RIVER, ARKANSAS.

No work has been done on this stream during the fiscal year ending June 30, 1899.

Since the appropriation of March 3, 1899, became available, the river has been at too high a stage for satisfactory work.

Channel.—The banks of this river are fairly stable, its navigable stages depending upon stages of White River. During extreme low water there is but 6 to 8 inches of water in the channel over the shoals. The stream is generally narrow, the banks generally low and heavily timbered. Fallen timber will, in many places, entirely block the channel, and the stream is reported as badly obstructed at this time.

Money statement.

Amount appropriated by river and harbor act approved March 3, 1899	$1,000.00
July 1, 1899, balance unexpended	1,000.00

APPROPRIATIONS AND ALLOTMENTS.

August 11, 1888, mouth to Riverside	$7,000.00
July 13, 1892, mouth to Riverside	2,000.00
August 17, 1894, allotted from White River	2,000.00
June 3, 1896, allotted from White River	2,000.00
March 3, 1899, mouth to James Ferry	1,000.00
Total	14,000.00
Expended to June 30, 1898	12,621.16
Unexpended July 1, 1898	378.84
Appropriated by act of March 3, 1899	1,000.00
	14,000.00

COMMERCIAL STATISTICS.

This stream was not navigable from July 15 to September 1, 1898.

List of steamboats navigating Cache River, Arkansas, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamers.		Barges.				
		Ft.	*in.*	*Ft.*	*in.*			
Iolanthe	5	1	8	2	1	Maberry and Cache River Bridge	16	15
Black Diamond	18	2	6	3	0	Maberry and Cache River Bridge	13	71
Emma	5	3	0	3	0	De Vall Bluff and Kalache Bay	2	....

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	50	....	....	....	....
Cotton seed	2	....	....	....	....
Live stock	2	....	....	....	....
Lumber	332	1,176	800	44	....
Staves and bolts	891	1,377	20,980	13,034	....
Provisions	100	....	....	....	....
Saw logs	4,220	7,040	12,270	7,670	12,186
Square timber	2,050	....	....	....	....
Miscellaneous freights	20	600	940	....	417
Total freights	7,667	10,193	34,990	20,748	12,603
Estimated value	$52,936	$36,635	$108,460	$62,483	$25,494

X 7.

IMPROVEMENT OF BLACK RIVER, ARKANSAS AND MISSOURI.

In August, 1898, the snag-boat *Sheldon* made a patrol over the river from its mouth to the mouth of Current River, 146 miles, and found the river in fair condition. Fifty-two snags were removed, seven overhanging trees were cut, and one drift broken up. This boat made a short trip to Strawberry Cut-off in June, and worked four days, removing 28 snags and cutting 10 trees.

Channel.—This stream is reported as being badly obstructed in its upper reaches by snags and fallen timber, more especially so in the vicinity of Big Island, Missouri. This reach of the river takes in what is called the "The Chute" and "Duck Roost." These places have always been troublesome. Below the mouth of Current River, 3 feet was the shoalest water reported during the year. This depth was found at Bettie Cravin Shoal, Kincade Bar, Spring River Shoal, and Julia Dean Bar.

Money statement.

July 1, 1898, balance unexpended	$1,246.80
Amount appropriated by river and harbor act approved March 3, 1899	8,000.00
	9,246.80
June 30, 1899, amount expended during fiscal year	1,138.71
July 1, 1899, balance unexpended	8,108.09
July 1, 1899, outstanding liabilities	225.00
July 1, 1899, balance available	7,883.09
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	8,000.00

APPROPRIATIONS.

Appropriations have been made for this stream separately under the head of "Improving Black River, Missouri," and "Improving Black River, Arkansas and Missouri." They are as follows:

June 14, 1880	$15,000.00	September 19, 1890	$7,000.00
March 3, 1881	6,000.00	July 13, 1892	5,000.00
August 2, 1882	10,000.00	August 18, 1894	9,500.00
July 5, 1884	20,000.00	June 3, 1896	8,000.00
August 5, 1886	5,000.00	March 3, 1899	8,000.00
August 11, 1888	5,000.00		
August 11, 1888	7,000.00	Total	110,500.00
September 19, 1890	5,000.00		

Expended to June 30, 1898	$101,253.20
Unexpended July 1, 1898	1,246.80

COMMERCIAL STATISTICS.

The river was reported navigable to Poplar Bluff the year round by boats of 16-inch draft. The reaches above the mouth of Current River gave considerable trouble in the months of August, September, and October, 1898. Below the mouth of Current River the river was navigable all the year by boats of not over 3-foot draft.

List of steamboats navigating Black River, Arkansas and Missouri, May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamers.		Barges.				
		Ft.	*in.*	*Ft.*	*in.*			
Roy	25	3	0	3	6	Various points between Black Rock and Poplar Bluff.	260	(?)
Quickstep	66	2	6	5	0	Newport and Paradise	95	168
W. J. Bryan [a]	68	4	0	4	0	....do	4	22
A. R. Bragg	116	4	0	....		Black Rock and Newport	39	78
Krata	47	3	6	3	6	Black Rock and Johnson	64	260
						Black Rock and Martin	52	
						Black Rock and Newport	18	
F. W. Tucker	100	4	0	3	6	Newport and Johnson	8	....
						Black Rock and Newport	45	....
						Black Rock and Martin	45	....
Arthur	13	0	14	....		Various points near Poplar Bluff	14	100
W. T. Harwell	24	2	0	3	6	Poplar Bluff and Corolla	27	64
Louisa	....	1	8	3	6	....do	18	200
						Poplar Bluff and Marshall Mill	30	
						Marshall Mill and Lake Slough	35	
						Poplar Bluff and Old River	24	

[a] Sank, 4 miles above Elgin, August 20, 1898.

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	847	2,977	2,426	2,181	1,478
Coton seed	883	1,224	1,319	920	6,320
Hides	....	....	110	60	96
Live stock	....	3	125	62	57
Lumber	22,840	12,167	10,646	12,912	12,840
Staves and bolts	9,710	17,856	24,995	5,865	8,171
Provisions	602	184	5,404	1;010	2,694
Grain	146	162	194	738	495
Spokes	579	....	....	....	437
Saw logs	40,882	67,922	58,880	76,073	83,931
Railroad ties	1,500	8.782	4,670	7,184	13,441
Piling	....	....	....	2,400	400
Square timber	60	1,600	1,860	1,045	1,500
Miscellaneous freights	855	2,735	1,482	818	578
Total freights	78,404	115,612	111,611	111,278	132,438
Estimated value	$519,336	$788,640	$1,704,799	$891,437	$1,085,415

X 8.

IMPROVEMENT OF CURRENT RIVER, ARKANSAS AND MISSOURI.

Work done.—The snag boat *Sheldon* made a patrol over this river from its mouth to Johnson (25 miles) in August, 1898, removing 33 snags, cutting 13 trees, and breaking up 4 drift piles. While working in Wild Cat Chute, August 11, the boat struck a log projecting from the bank and broke a hole in the starboard side. The hole was covered by temporary battens and the boat ran to Newport, where it was side docked and the hole repaired.

Channel.—No opportunity for recent inspection of this stream has offered. Its low-water depths from the mouth to Johnson are said to be 3½ feet; from Johnson to Little Black River, 8 miles, 2 feet, and from Little Black River to Buffalo Creek, 32 miles, 16 inches. Timber men report considerable work required on this stream between the mouth and the Missouri State line, about 43 miles.

The appropriation of June 3, 1896, completed the amount estimated for the completion of the project. The last appropriation, March 3, 1899, was made for continuing improvement and for maintenance.

Money statement.

July 1, 1898, balance unexpended	$1, 161. 26
Amount appropriated by river and harbor act approved March 3, 1899	5, 000. 00
	6, 161. 26
June 30, 1899, amount expended during fiscal year	1, 088. 31
July 1, 1899, balance unexpended	5, 072. 95
July 1, 1899, balance available	5, 072. 95
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2, 000. 00

APPROPRIATIONS.

The early examinations of this river were made under appropriations for this in combination with other streams. The independent appropriations for this stream are as follows:

June 2, 1872, Current River, Missouri	$5, 000. 00
March 3, 1881, Current River, Arkansas and Missouri	2, 000. 00
August 18, 1894, Current River, Arkansas and Missouri	8, 000. 00
June 3, 1896, Current River, Arkansas and Missouri	2, 000. 00
March 3, 1899, Current River, Arkansas and Missouri	5, 000. 00
Total	22, 000. 00
Expended to June 30, 1898	15, 838. 74
Unexpended July 1, 1898	1, 161. 26

COMMERCIAL STATISTICS.

The commerce of this stream consists chiefly of rafted material. Cotton, cotton seed, lumber, and some miscellaneous freights were handled on steamers that did not navigate the stream above Johnson.

List of steamboats that navigated Current River, Arkansas and Missouri, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamers.		Barges.				
		Ft.	*In.*	*Ft.*	*In.*			
Krata	47	3	6	3	6	Black Rock and Johnson	64	198
F. W. Tucker	100	4	0	3	6	Newport and Johnson	8	....

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	740	812	610	719	875
Cotton seed	464	395	800	423	550
Lumber	480	3,048	380	292	1,026
Staves and bolts	560	2,759	920	1,375	4,225
Grain	....	44	20	330	175
Provisions	50	....	2,520	200	540
Saw logs	21,353	31,258	10,070	23,730	13,479
Railroad ties	750	5,083	....	1,667	8,333
Square timber	....	2,740	1,360	1,045	1,500
Miscellaneous freights	60	6,278	398	86	502
Total freights	24,457	52,417	17,078	29,867	31,205
Estimated value	$185,259	$306,216	$581,528	$227,291	$362,447

X 9.

IMPROVEMENT OF ST. FRANCIS RIVER, ARKANSAS.

Other than care of the snag boat owned by this appropriation, nothing has been done during the fiscal year ending June 30, 1899. Since the appropriation of March 3, 1899, became available the river has been at too high a stage for snagging operations.

Channel.—No opportunity for recent inspection of this stream has offered. The banks are generally permanent, and the low-water depths from 12 to 14 inches on crossings. The low-water periods are five to seven months long, the navigable periods depending upon the stages of the Mississippi River.

Money statement.

July 1, 1898, balance unexpended	$673.89
Amount appropriated by river and harbor act approved March 3, 1899	8,000.00
	8,673.89
June 30, 1899, amount expended during fiscal year	582.54
July 1, 1899, balance unexpended	8,091.35
July 1, 1899, outstanding liabilities	100.00
July 1, 1899, balance available	7,991.35
Amount that can be profitably expended in fiscal year ending June 30, 1901, for maintenance of improvement Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	8,000.00

APPROPRIATIONS.

The earlier examinations and the earlier operations were made under appropriations for this in conjunction with other rivers. Of the expenditures under these appropriations this office has no record.

The separate appropriations are as follows:

March 3, 1871	$10,000.[illegible]
June 14, 1880	5,000.[illegible]
July 5, 1884	12,000.[illegible]
August 5, 1886	8,000.[illegible]
August 11, 1888	4,000.[illegible]
September 19, 1890	4,000.[illegible]
August 18, 1894	[1] 83,000.[illegible]
June 3, 1896	8,000.[illegible]
March 3, 1899	8,000.[illegible]
Total	142,000.[illegible]
Expended to June 30, 1898	58,326.11
Unexpended July 1, 1898	673.[illegible]

COMMERCIAL STATISTICS.

No boats report doing any business above Wittsburg. The river was not navigable to this point from July 1 to December 1, 1898.

List of steamboats that navigated St. Francois River, Arkansas, from May 31, 1898, to June 1, 1899.

Name.	Tonnage.	Draft, loaded.		Between—	Round trips.	Passengers.
		Steamers.	Barges.			
		Feet.	*Feet.*			
L. E. Patton	92	3	4	Memphis and Wittsburg	(*a*)	
Rock City	94	3		Helena and Wittsburg	55	
New Mattie	130	5		Memphis and Marianna	8	15
John	8	(*a*)		Madison and Wittsburg	1	

a Not reported.

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	968	402	1,740	575	[illegible]
Cotton seed	2,723	1,410	5,021	731	1,173
Hides		8	20	3	19
Live stock	163	642	2,570	300	61
Lumber	900	2,270	10,350	5,690	4,[illegible]
Staves and bolts	415	6,874	14,512	5,934	7,[illegible]
Provisions	200	100	2,585	751	271
Grain	10	788	1,650	280	[illegible]
Saw logs	21,895	9,545	58,330	51,700	22,[illegible]
Railroad ties	335	1,250	100	1,670	
Miscellaneous freights	283	530	520	106	1,[illegible]
Total freights	27,892	23,819	97,348	67.740	38,107
Estimated values	$315,459	$237,481	$1,117,891	$401,457	$621,[illegible]

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[1] Seventy-five thousand dollars of this, by the conditions of the act, were to be expended by the Mississippi River Commission.

X 10.

IMPROVEMENT OF ST. FRANCIS RIVER, MISSOURI.

No work has been done on this stream since the close of the fiscal year ending June 30, 1897. The property belonging to this appropriation was shipped to Little Rock in March, 1898. The small balance that was on hand at the close of fiscal year ending June 30, 1898, was used in paying freight charges and in care of the property.

Timber men report the channel greatly obstructed by snags and logs at low stages.

Money statement.

July 1, 1898, balance unexpended	$59.97
June 30, 1899, amount expended during fiscal year	59.97

APPROPRIATIONS.

This reach of river is understood not to have been included in the snagging operations under the early appropriations for snagging in Western rivers. Its specific appropriations are as follows:

August 11, 1888	$5,000.00
September 19, 1890	10,500.00
August 18, 1894	5,000.00
Total	20,500.00
Expended to June 30, 1898	20,440.03
Unexpended July 1, 1898	59.97

COMMERCIAL STATISTICS.

The commerce of this stream is that arising solely from lumber industries. It is reported that nearly all of the stave timber has been cut, and that stave men are going to other localities. The steamer *El Blanco,* 51 tons, 20-inch draft, is the only boat reporting from this stream this year. It was engaged in towing timber and lumber to Poplin, Mo., making only short runs to nearby points.

The stream was not navigable from August 1 to September 15, 1898.

Classification of commerce reported.

Articles.	1899.	1898.	1897.	1896.	1895.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Lumber	6,325	2,604	1,830	700	3,100
Staves and bolts	2,632	1,676	7,547	9,660	7,106
Provisions	20	46	10	....	50
Grain	....	83	45	....	11
Miscellaneous freights	250	25	49	....	59
Spokes	....	....	....	2,100	....
Saw logs	8,550	15,554	11,714	17,400	12,000
Piling	1,582	1,221	927	4,762	....
Square timber	....	....	110	....	....
Railroad ties	....	1,961	1,074	875	....
Total freights	19,359	23,170	23,306	35,497	22,326
Estimated value	$72,601	$72,873	$75,425	$135,029	$79,091

This river is crossed near Wappapello by the Cape Girardeau and Fort Smith Railway, at Poplin by the Poplar Bluff and Cairo Branch of the St. Louis, Iron Mountain and Southern Railway, and at St. Francis by the St. Louis Southwestern Railway.

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